

PAWTUXET RIVER BASIN
WARWICK, RHODE ISLAND

NATICK POND DAM

R.I. 03801

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

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DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS. 02154

JUNE 1979

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Warwick Rhode Island

Pawtuxet River

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The dam is a composite masonry and earth dam. The entire length of the dam
is about 263 ft. The dam is judged to be in generally fair condition owing
to the absence of dewatering facilities and inadequate spillway capacity.
Young trees are growing in the pier area on the left abutment. It is small in
size with a high hazard potential. There are various remedial measures which
require attention by the owner.

DD

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SECTION 7

ASSESSMENT, RECOMMENDATIONS & REMEDIAL MEASURES

7.1 Dam Assessment

a. Condition. On the basis of the Phase I visual examination, Natick Pond Dam appears to be in generally fair condition. The deficiencies revealed, however, indicate that a further investigation should be carried out and that some remedial work is needed. The major concerns with regard to the overall integrity of the dam are as follows:

- (1) The inadequacy of the spillway and the overtopping potential of the millrace.
- (2) The presence of small trees in the pier on the left abutment.
- (3) The need for a further inspection of the ashlar face on the downstream side of the spillway and of the condition of the plunge pool below the toe of the dam at a time of low flood.
- (4) The lack of dewatering facilities.

In addition, of minor concern, is the presence of small trees and brush in the river channel downstream of the dam.

b. Adequacy of Information. The lack of in-depth engineering data does not permit a definitive review. Therefore, the adequacy of the dam cannot be assessed from a standpoint of reviewing design and construction data. This assessment is based primarily on the visual inspection, past performance, and sound engineering judgment.

c. Urgency. The recommendations and remedial measures enumerated below should be implemented by the owner within one year after receipt of this Phase I inspection report.

d. Need for Additional Investigations. Additional investigations are required as recommended in Para. 7.2.

7.2 Recommendations

It is recommended that the owner should retain the services of a competent registered professional engineer to make investigations and studies of the following, and if proved necessary, to design appropriate remedial works:

- (1) Make a thorough study of the hydrology of the drainage basin. Review the spillway adequacy and the overtopping potential of the old raceway fill and determine whether it should be raised.
- (2) Determine whether repairs are needed along the downstream face of the spillway or in the riverbed at the toe of the dam.

- (3) Inspect the overflow section of the dam during periods of low or no flow conditions.
- (4) Determine whether modifications to the crest of the overflow structure are required to aerate the underside of the overflow nappe.
- (5) Study the feasibility of incorporating dewatering facilities.

7.3 Remedial Measures

a. Operating and Maintenance Procedures

- (1) Remove small trees, brush and shrubs in the river channel to a distance of 500 ft. downstream of the spillway.
- (2) Remove saplings growing in the pier area on the left abutment.
- (3) Develop a formal flood warning plan to follow in the event of an emergency including round-the-clock monitoring during periods of heavy precipitation.
- (4) Institute procedures for an annual periodic technical inspection of the dam and its appurtenant structures.

7.4 Alternatives

The only practical alternative would be to breach the dam under the auspices of a registered professional engineer, with due consideration of environmental effects.

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DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM, MASSACHUSETTS 02154

REPLY TO
ATTENTION OF:

NEDED

SEP 29 1979

Honorable J. Joseph Garrahy
Governor of the State of Rhode Island
and Providence Plantations
State House
Providence, Rhode Island 02903

Dear Governor Garrahy:

Inclosed is a copy of the Natick Pond Dam Phase I Inspection Report, which was prepared under the National Program for Inspection of Non-Federal Dams. This report is presented for your use and is based upon a visual inspection, a review of the past performance and a brief hydrological study of the dam. A brief assessment is included at the beginning of the report. I have approved the report and support the findings and recommendations described in Section 7 and ask that you keep me informed of the actions taken to implement them. This follow-up action is a vitally important part of this program.

A copy of this report has been forwarded to the Department of Environmental Management, the cooperating agency for the State of Rhode Island. In addition, a copy of the report has also been furnished the owner, Mr. Ronald Ruggierri, 27 Blossom Street, West Warwick, Rhode Island 02893.

Copies of this report will be made available to the public, upon request, by this office under the Freedom of Information Act. In the case of this report the release date will be thirty days from the date of this letter.

I wish to take this opportunity to thank you and the Department of Environmental Management for your cooperation in carrying out this program.

Sincerely,

Max B. Scheider
MAX B. SCHEIDER

Colonel, Corps of Engineers
Division Engineer

Incl
As stated

NATICK POND DAM

RI 03801

PAWTUXET RIVER BASIN
WARWICK, RHODE ISLAND

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

NATIONAL DAM INSPECTION PROGRAM
PHASE I INSPECTION REPORT

Identification No.: RI 03801
Name of Dam: Natick Pond Dam
Town: Warwick
County and State: Kent County, Rhode Island
Stream: Pawtuxet River
Date of Inspection: 3 April 1979

BRIEF ASSESSMENT

Natick Pond Dam is a composite masonry and earth dam with a 166 ft. downstream ashlar faced masonry overflow section, a granite block right abutment, a left abutment non-overflow section consisting of an earth-filled granite masonry pier, and an abandoned earth-filled mill raceway. The entire length of the dam is about 263 ft. It is a run-of-the-river dam which once furnished the water needs for the now defunct Natick Mills. There are no dewatering facilities at the project.

Natick Pond is about 1.5 miles long and has a surface area at spillway level of about 46 acres. The drainage area above the dam is about 182 sq. mi. and the maximum storage to the top of dam is estimated at about 700 acre-ft. The height of the dam is 25 ft.; the size classification is thus small. A breach of the dam would affect more than a few homes and cause extensive community economic loss, with the possibility of some loss of life. Several local roads and State Route 33 would be affected by the high water. The dam has been classified as having a high hazard potential.

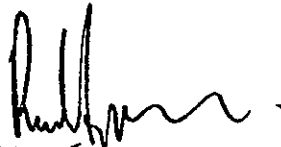
The dam is judged to be in generally fair condition owing to the absence of dewatering facilities and inadequate spillway capacity. However, water was flowing to a depth of about 1 ft. over the crest of the spillway at the time of the inspection, so that it was not possible to observe the condition of the downstream ashlar face, or to determine whether there is any erosion at the toe of the dam. Nevertheless, the water appeared to be flowing uniformly along the downstream face with no evidence of turbulence or missing or eroded elements. Trees and brush have become established in the river channel downstream of the spillway. Young trees are growing in the pier area on the left abutment.

The spillway is not adequate to pass the PMP flood outflow of 34,000 cfs without overtopping the non-overflow section or filled raceway channel. The test flood would overtop the raceway channel fill by about 10 ft. The spillway can pass about 14 percent of the test flood without overtopping the raceway fill. The total spillway capacity at top of the raceway fill, elevation 53.0 MSL is 4,700 cfs. The inflow-outflow disparity was considered to be insignificant.

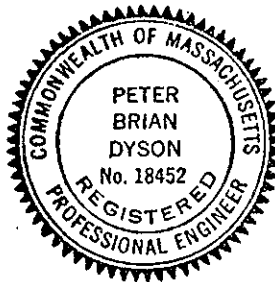
Within one year after receipt of this Phase I Inspection Report, the owner, Mr. Rinaldo Ruggieri, should retain the services of a registered professional engineer and implement the results of his evaluation of the following: (1) whether the raceway entrance fill should be raised to forestall spills through the old mill race area; (2) whether repairs are needed along the downstream face of the spillway or in the riverbed at the toe of the dam; (3) inspect the overflow section of the dam during periods of low or no flow conditions;

(4) whether modifications are required at the crest to aerate the underside of the overflow nappe; and (5) study the feasibility of incorporating dewatering facilities.

The owner should also implement the following operating and maintenance measures: (1) clear trees and brush in the river channel downstream of the spillway; (2) remove saplings growing in the pier area on the left abutment; (3) develop a formal surveillance and flood warning plan; and (4) institute procedures for an annual periodic technical inspection.



Peter B. Dyson
Project Manager



PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation: however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aide in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

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APPENDIX B - ENGINEERING DATA

APPENDIX C - PHOTOGRAPHS

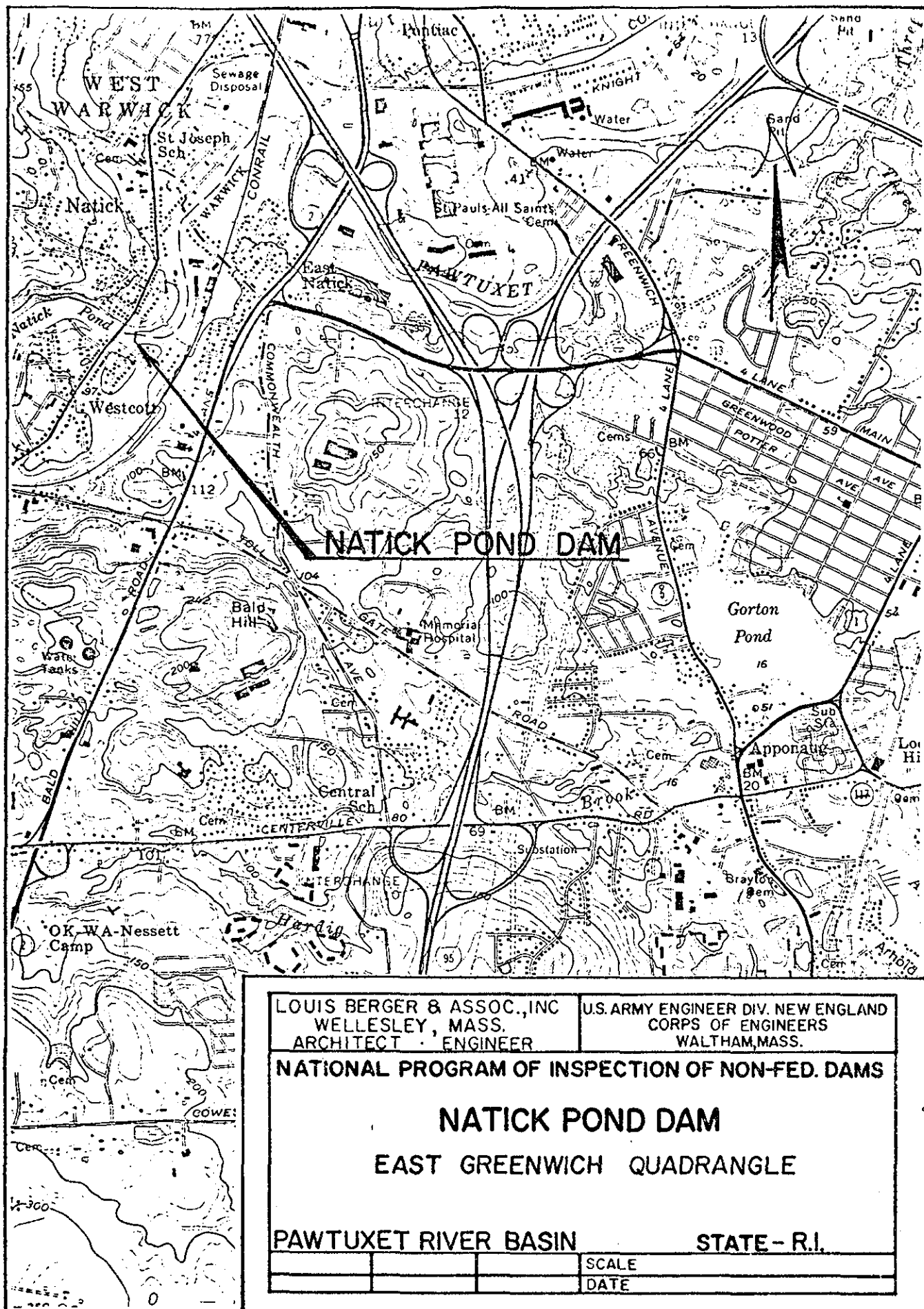
APPENDIX D - HYDROLOGIC AND HYDRAULIC COMPUTATIONS

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INVENTORY OF DAMS

NATICK POND DAM



Overview Photo from right abutment



PHASE I INSPECTION REPORT

NATICK POND DAM RI 03801

SECTION 1 - PROJECT INFORMATION

1.1 General

a. Authority. Public Law 92-367, August 8, 1972, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a national program of dam inspection throughout the United States. The New England Division of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the New England Region. Louis Berger & Associates, Inc. has been retained by the New England Division to inspect and report on selected dams in the State of Rhode Island. Authorization and notice to proceed was issued to Louis Berger & Associates, Inc. under a letter of 19 March 1979 from John P. Chandler, Colonel, Corps of Engineers. Contract No. DACW33-79-C-0051 has been assigned by the Corps of Engineers for this work.

b. Purpose.

(1) Perform technical inspection and evaluation of non-Federal dams to identify conditions which threaten the public safety and thus permit correction in a timely manner by non-Federal interests.

(2) Encourage and assist the States to initiate quickly effective dam safety programs for non-Federal dams.

(3) Update, verify and complete the National Inventory of Dams.

1.2 Description of Project

a. Location. Natick Pond and dam are located on the Pawtuxet River about 9.8 miles upstream from the river's confluence with the Providence River. The damsite is in the city of Warwick, Kent County, Rhode Island. It is shown on U.S.G.S., Quadrangle East Greenwich, Rhode Island, with coordinates approximately at N 41° 43' 06", W 71° 29' 30".

b. Description of Dam and Appurtenances. Natick Pond Dam is a run-of-the-river dam constructed in 1886 as part of a mill complex. Sometime in the past the mill was abandoned and the dam no longer serves its original intent.

Essentially the dam consists of a 166 ft. long straight overflow section, with left and right ashlar masonry abutments. To the left of the left abutment is a filled-in mill race. An earth-filled granite masonry non-overflow pier is located between the spillway and the old mill race. The overflow section on the downstream face is of ashlar masonry with mortared joints. The downstream slope has a batter of approximately 1 horizontal to 5 vertical. A wooden sill along the spillway crest serves as a control. The upstream face of the masonry dam has a variable slope. According to an old construction plan, the upstream

top surface is covered with a thin concrete facing on about a 1 to 1 slope, upon which a wooden facing was placed. Covering this upstream is an earth fill with a slope of approximately 3 horizontal to 1 vertical. The right abutment is well exposed bedrock for a distance of about 500 ft. downstream of the dam. The left abutment millrace at its entrance was spanned by a headworks containing six wooden head gates. The wooden gates were removed in 1974 and the old mill race has been filled in for a distance of approximately 300 ft. downstream of the dam. A granite masonry training wall between the spillway and the millrace extends 500 ft. or more downstream from the dam.

The total length of the dam is about 263 ft. The spillway section is shown to be founded on bedrock.

c. Size Classification. Natick Pond Dam has a hydraulic height of 25 ft. above downstream river level, and impounds a normal storage of about 500 acre-ft. to spillway crest level and a maximum of about 700 acre-ft. to the old mill race level. In accordance with the size and capacity criteria given in Recommended Guidelines for Safety Inspection of Dams, the project falls into the small category for both criteria and therefore is classified accordingly.

d. Hazard Classification. The Pawtuxet River below Natick Pond Dam traverses along about 9.8 mi. of low-lying urban developed land. Immediately below the dam on the right bank of the river about 7 ft. above riverbed there is a new housing development. The community of Natick is located about 2,000 ft. downstream of the dam on the left bank about 10 ft. above river level. Across the river from Natick are several industrial buildings well within the flood plain of the river. The gradient of the river through this reach is about 1.5 ft. per mile. Below the community of Natick the river traverses through a wider valley where it is expected that a flood stage would be considerably reduced from that immediately downstream from the dam. The river passes under Interstate Route 295 about a mile downstream from the dam.

The river section for about 3/4 mile downstream from Natick Dam is a narrow confined channel. A breach failure of the dam when the river was at the crest of the overflow section, elevation 48.6 MSL, would release a sudden flood wave, from zero stage to a stage of as much as 16 ft. deep.

Such a sudden breach of the dam would cause the loss of more than a few lives and result in extensive community and industrial economic losses. Consequently, Natick Pond Dam has been classified as having a high hazard potential, in accordance with the Recommended Guidelines for Safety Inspections of Dams.

e. Ownership. Natick Pond Dam is owned by the Quidwik Reservoir Association, c/o NATCO Products Inc., 33 Factory Street, West Warwick, Rhode Island 02893.

The dam is believed to have been constructed in 1886 by the Natick Mills for use in their textile milling operation. After the mills were closed by strike and ravaged by fire, the ownership passed through other hands. State of Rhode Island records indicate that the dam was owned by a Mr. Clifford D. Stone in 1968, by the Natick Land Company in 1946, and by the Natick Wadding Company in 1940.

f. Operator. Mr. Rinaldo Ruggieri, 27 Blossom Street, West Warwick, Rhode Island. Telephone: (401) 822-0514.

g. Purpose of Dam. The dam was originally constructed to create industrial water storage for the Natick Mills. At the present time the reservoir is not utilized, except possibly for fishing.

h. Design and Construction History. Little information is available regarding the original design and no information is available regarding the original construction of the dam. The dam is believed to have been constructed in 1896 by the Natick Mills for use in their textile milling operations. One plan exists showing a section and elevation of the spillway, right abutment and part of the left abutment, (See Appendix B).

The gate house and six raceway gates were removed in 1974. In this area the old mill raceway was filled with rocky material for a distance of approximately 300 ft. downstream of the dam. However, for a distance of 20 to 30 ft. from the crest, the fill appears to be more sandy and contains fines. The reconstruction plans shown in Appendix B do not conform with the conditions observed during the field inspection.

i. Normal Operating Procedure. There are no operational procedures for Natick Pond Dam.

1.3 Pertinent Data

a. Drainage Area. The drainage area above Natick Pond Dam consists of about 182 sq. mi., described in general as a flat and coastal area. It encompasses a sizable portion of the state of Rhode Island and extends nearly to the Connecticut state line. In the upper reaches of the drainage area the topography is generally heavily wooded, rolling terrain. The lower reach area is highly urbanized and tends to be flat. The area contains numerous power plants and reservoirs, the largest reservoir being the Scituate Reservoir located about 8 miles upstream of the Natick Pond Dam. Scituate Reservoir has a drainage area of about 92.8 sq. mi.

b. Discharge at Damsite.

(1) Outlet works conduit. None.

(2) Maximum Known Flood at Damsite. The maximum known discharge at dam-site is unknown. However, the maximum discharge at U.S.G.S. Station 01116500 located about 5 miles downstream at Cranston, RI, having a period of record from 1939 to the present and a drainage basin of 200 sq. mi., was 4,000 cu. ft./sec. on January 26, 1979.

(3) Ungated Spillway Capacity at Top of Dam. The total spillway capacity at top of the raceway fill, elevation 53.0 MSL is 4,700 cfs.

(4) Ungated Spillway Capacity at Test Flood Elevation. The ungated spillway capacity is about 28,600 cfs at test flood elevation 63.1 MSL.

- (5) Gated Spillway Capacity at Normal Pool Elevation. Not applicable.
- (6) Gated Spillway Capacity at Test Flood Elevation. Not applicable.
- (7) Total Spillway Capacity at Test Flood Elevation. The total spillway capacity at the test flood elevation is 28,600 cfs at elevation 63.1 MSL.
- (8) Total Project Discharge at Test Flood Elevation. The total project discharge at test flood is 34,700 cfs at elevation 63.1 MSL.

c. Elevations (Ft. above MSL)

- (1) Streambed at centerline of dam - 27.6
- (2) Maximum tailwater - Unknown
- (3) Upstream portal invert diversion tunnel - Not applicable
- (4) Recreation pool - Not applicable
- (5) Full flood control pool - Not applicable
- (6) Ungated spillway crest - 48.6
- (7) Design surcharge (original design) - Unknown
- (8) Top of raceway fill - 53.0 (+)
- (9) Top of non-overflow abutment - 58.0 (+)
- (10) Test flood design surcharge - 63.1

d. Reservoir

- (1) Length of maximum pool - 1.5 miles
- (2) Length of recreation pool - Not applicable
- (3) Length of flood control pool - Not applicable

e. Storage (acre-ft.)

- (1) Recreation pool - Not applicable
- (2) Flood control pool - Not applicable
- (3) Spillway crest pool El. 48.6 - 500
- (4) Top of raceway fill El. 53.0 (+) - 700
- (5) Top of non-overflow abutment El. 58.0 (+) - 1100
- (6) Test Flood Pool El. 63.1 - 1420

f. Reservoir Surface (acres)

- (1) Recreation pool - Not applicable
- (2) Flood control pool - Not applicable
- (3) Spillway crest El. 48.6 - 46
- (4) Top raceway fill 53.0 (+) - 65
- (5) Top of non-overflow abutment El. 58.0 (+) - 90
- (6) Test flood pool El. 63.1 - 120

g. Dam

- (1) Type - Gravity overflow with downstream masonry section and upstream earth fill
- (2) Length - 263 ft.
- (3) Height - 25 ft.(+)
- (4) Top width - Varies
- (5) Side slopes - overflow section - Downstream 1 horizontal to 5 vertical
Upstream, 3 horizontal to 1 vertical
- (6) Zoning - Unknown
- (7) Impervious core - Unknown
- (8) Cutoff - Unknown
- (9) Grout curtain - Unknown

h. Diversion and Regulating Tunnel - Not applicable

i. Spillway

- (1) Type - Overflow gravity dam (downstream face - 1 horizontal to 5 vertical)
- (2) Length of weir - 166 ft.
- (3) Crest elevation - 48.6
- (4) Gates - None
- (5) Upstream channel - Natural river channel
- (6) Downstream channel - Natural river channel with exposed bedrock on left,
ashlar masonry training wall on right.
- (7) General - Spillway flows directed into channelized river.

j. Regulating Outlets - None

SECTION 2

ENGINEERING DATA

2.1 Design Data

No original design data of the nineteenth century dam has been recovered except for one plan showing elevations and a section of part of the dam (See Appendix B). The 1964 reconstruction of the raceway gate area was designed by Peter V. Cipallo Co., Inc. of Cranston, RI. Copies of drawings which are pertinent to this reconstruction are included in Appendix B.

2.2 Construction Data

No information relating to construction of the original dam has been found, except for the plan mentioned above. The reconstructed raceway gate area was built in 1964 by an unknown contractor.

2.3 Operation Data

There are no operating devices at this dam.

2.4 Evaluation of Data

a. Availability. Since little engineering data is available, it is not possible to make an assessment of the safety of the embankment. The basis of the information presented in this report is principally the visual observations of the inspection team.

b. Adequacy. The lack of in-depth engineering data did not allow for a definitive review. Therefore, the adequacy of this dam could not be assessed from the standpoint of reviewing design and construction data, but is based primarily on visual inspection, past performance history and sound engineering judgment.

c. Validity. Not applicable.

SECTION 3

VISUAL INSPECTION

3.1 Findings

a. General. The visual inspection of Natick Pond Dam took place on 3 April 1979. At that time the ponded water surface was about 1 ft. above the spillway crest. The discharge over the spillway crest was about 500 cfs. A new housing development of about seven houses has recently been built about 700 ft. downstream of the dam on the right bank of the river. The dam was judged to be in fair condition owing to the absence of dewatering facilities and inadequate spillway capacity. There was no evidence of any major maintenance problems, but two minor items require attention (See Section 7.3).

b. Dam. The dam is a run-of-the-river dam with an overall length of about 263 ft. The right granite masonry abutment is founded on bedrock, which is well exposed for a distance of about 500 ft. downstream of the dam. The left abutment contains a filled-in mill race which formerly contained six wooden trench gates; these were demolished in 1974. The mill race below the gates formerly connected to a mill downstream on the left bank of the river. There is an earth fill between the left training wall of the spillway and the right training wall of the mill race (See Photo Nos. 3 & 4, Appendix C). Several small trees are growing in this area. The earth fill is shown to be a "puddle" fill, according to an old drawing. The base of the dam is founded on bedrock. The old mill race has been filled in for a distance of approximately 300 ft. downstream of the dam. The fill appears to be of a very blocky rock type, which may have voids in it. However, at the upstream end, the fill appears to be more sandy, containing more fines. These fines extend downstream for a distance of 20 to 30 ft. No evidence of any major seepage through this area was noted. (See Overview Photo, Page V)

c. Appurtenant Structures.

(1) Spillway. The overflow portion of the main dam forms the spillway, an ashlar faced masonry gravity structure with mortared joints. The downstream slope of this section is approximately 1 horizontal to 5 vertical. There is a wooden central sill along the crest of the structure. The upstream masonry face has a variable slope. It is covered with a thin concrete layer, which is covered with a woodface and then an earthfill approximately 3 horizontal to 1 vertical. At the time of the inspection, the water was flowing to a depth of approximately 1 ft. over the crest; therefore it was not possible to observe the condition of the downstream ashlar face. However, the water appeared to be flowing uniformly with no evidence of turbulence or missing or eroded elements. Thus, the structure is believed to be in good condition. Nevertheless, the face should be inspected under conditions of low flow (See Section 7.2).

The original drawings showed a riprap apron at the downstream toe of the dam. Because of the tailwater depth and turbulence at the toe of the dam at the time of inspection, it could not be ascertained whether the apron riprap was still in place or whether a plunge pool had been scoured at the point of jet impingement.

(2) Old Mill Raceway. Beyond the filled-in portion of the raceway, the old mill race runs through an abandoned and demolished mill building and then through the 10 ft. dia. deteriorated arch flumes that connect to the river. (See Photo No. 1, Appendix C).

(3) Left Training Wall. A training wall between the spillway and mill race extends downstream of the dam. The training wall is a granite masonry wall with mortared joints. The wall looks even and square and is in good condition for a distance of about 500 ft. or more downstream of the left abutment.

(4) Outlets. There are no dewatering facilities at this project.

d. Reservoir Area. The reservoir is a ponding of the Pautuxet River. About one mile upstream of the dam the north branch and the south branch of the Pautuxet River join to form the Pautuxet River. The upper reaches of the pond extend into the confluence of the two branches. The reservoir slopes are steep on the north side and vary from steep to moderate on the southerly side, the steeper slopes lying just upstream of the dam. State Route 33 crosses the reservoir area about 250 ft. upstream of the dam (See Photo No. 2, Appendix C). The reservoir is also spanned by a power line and by two railway lines in the very upper reaches of the pond. About seven houses are located just upstream of Route 33 on the pond's northern bank. All appear to be situated so as not to be affected by a reservoir rise owing to a large inflow. Possibly 3 houses on the southern slopes could be affected by high inflows.

e. Downstream Channel. Beyond the dam the channel is about 170 ft. wide. A training wall forms the left bank, extending downstream into the old mill area. The right bank is well exposed bedrock which extends a distance of about 500 ft. downstream of the dam. Small trees, brush and shrubs are growing in the river channel just downstream of the dam. About 700 ft. below the dam, on the right bank, a new housing development has been established. This area would be highly prone to damage from a breach of the dam, as it is about 7 ft. above streambed.

3.2 Evaluation

In general the visual inspection of the dam adequately revealed key characteristics of the project as they may relate to its stability and integrity, permitting an assessment to be made of those features affecting the safety of the structure. The only exception to the above was that it was not possible to observe the condition of the ashlar face of the spillway at the time of the inspection, due to the one ft. high flow over the crest of the dam. However, the water appeared to be flowing uniformly with no evidence of turbulence or missing or eroded elements. The Natick Pond Dam and appurtenant works are judged to be in fair condition owing to an absence of dewatering facilities and inadequate spillway capacity.

SECTION 4

OPERATIONAL PROCEDURES

4.1 Procedures

Mr. Rinaldo Ruggieri is the owner and operator of the dam. There are no operating devices and no operating procedures for the dam.

4.2 Maintenance of Dam

There is no specific maintenance program in effect at Natick Pond Dam.

4.3 Maintenance of Operating Facilities

The original gatehouse and gates for the dam have been removed. There are no operating facilities for the dam.

4.4 Warning System

No warning system is in effect at Natick Pond Dam.

4.5 Evaluation

Although little is known about construction of the dam, the reconstruction of the gatehouse area at the head of the old mill raceway is partly documented. Maintenance involves periodic growth removal from the pier and old raceway entrance, and surveillance regarding seeps. The owner should establish a formal warning system.

SECTION 5

HYDRAULIC/HYDROLOGIC

5.1 Evaluation of Features

a. General. The Natick Pond Dam is a run-of-the-river type project, originally constructed to furnish the water needs of the Natick Mills. The mill no longer exists. It is basically a low storage-high spillage dam. It is a granite block overflow gravity dam, with an earth fill now occupying the entrance to the old mill raceway.

b. Design Data. No hydrologic or hydraulic design data were retrieved for Natick Pond Dam.

c. Experience Data. No records are available in regard to past operation of the dam or of surcharge encroachments and outflows through the spillway. However, there is a U.S.G.S. Gauging Station located about 5 miles downstream having a period of record dating back to December 1939. The discharge of record at this gauge is 4,000 cfs occurring on January 26, 1979. The drainage area for the gauge is 200 sq. mi. compared with a drainage area above Natick Pond Dam of about 182 sq. mi.

d. Visual Observations. No evidence which would indicate possible high flows through the reservoir area or in the downstream channel has been noted.

e. Test Flood Analysis. Natick Pond Dam is about 25 ft. high and impounds about 700 acre-ft. to the top of dam and is therefore classified as small in size. Because of downstream conditions, the hazard potential is classified as high. In accordance with RECOMMENDED GUIDELINES FOR SAFETY INSPECTION OF DAMS, the recommended test flood is one half the probable maximum flood to a full probable maximum flood (PMF). Because of the downstream hazard potential the test flood adopted for evaluating the adequacy is the PMF.

The NED March 1978 Preliminary Guidance Memorandum for Estimating Maximum Probable Discharges listed a SPF study of the Pawtuxet River at a site downstream from Natick Pond Dam. This study showed a SPF flow of 19,000 cfs for a 200 sq. mi. drainage area. The PMF for this site was double that of the SPF, on a CSM of 190. Using this value the test flood discharge for Natick Pond Dam, having a drainage area of 182.4 sq. mi., was determined to be 34,700 cfs. Because of the high discharge and low storage capability of the impoundment above the dam, a storage-routing was not performed. The inflow-outflow disparity was considered to be insignificant.

A discharge curve for the dam was computed (see sheet D-3, Appendix D). With the reservoir to the top of filled raceway (elevation 53.0 MSL) the spillway can release about 4,750 cfs, or about 14 percent of the test flood. The overflow portion of the dam will not pass the test flood without an overtopping of the raceway fill or non-overflow abutments. The water depth over the old mill race fill would be about 10.2 ft. for the test flood and about 6.1 ft. for a 1/2 PMF flow. The left abutment would be overtopped by about 5 ft. for the test flood and 0.9 ft. for a 1/2 PMF flow.

f. Dam Failure Analysis. Removal of the original trench gates in the mill race and the filling-in of the raceway to a level about 5 ft. lower than the non-overflow abutment section of the dam has produced a structure for which the usual analysis is inappropriate. An analysis has therefore been made for the following two conditions:

Condition 1. Failure of raceway headworks and filled channel when headwater pond is at Elevation 54.0.

The raceway is about 300 ft. long and nearly level for its entire length. It was assumed that a flow of 1 ft. depth over the raceway crest (elev. 54.0 MSL vs. elev. 53.0 MSL) would be needed before a breach of the raceway headworks would occur.

If the raceway fill were washed away and the headworks structure were breached, for its full 55 ft. length and down to river level, about 8,400 cfs would be released down the river through this gap. At pond elevation 54.0, about 6,400 cfs would be flowing over the spillway, at a river stage of about 13 ft. above river bottom. After the breach, the total flow of 14,800 cfs would produce a stage of about 19 ft., or a sudden river rise of 6 ft. River valley routing downstream would produce discharges and river stages as shown on the following table.

River Section	Condition 1				Condition 2			
	Pond at El. 54.0		Pond @ El. 54.0		Pond at El. 48.6		65' wide breach of	
	No breaching of structure		Breach of raceway headworks		No breaching of structure		main overflow dam	
	Disch. cfs	River stage ft.	Disch. cfs	River stage ft.	Disch. cfs	River stage ft.	Disch. cfs	River stage ft.
Sta. 0 + 00 (toe of dam)	6,400	13	14,800	21	0	0	9,800	16
10 + 00	6,400	13	12,300	17	0	0	8,500	16
20 + 00	6,400	13	10,500	16	0	0	7,600	15
30 + 00	6,400	13	9,100	15	0	0	6,800	14
38 + 00	6,400	8	8,000	12	0	0	6,150	8
48 + 00	6,400	8	6,600	8	0	0	5,300	7.5
58 + 00	6,400	8	6,400	8	0	0	4,600	7

Condition 2. Failure of main overflow section with pond at spillway crest El. 48.6

If the main overflow section of the dam were to fail for a gap of about 40% of the length of the dam, a sudden surge of about 9,800 cfs would be released into the downstream channel. This outflow would diminish as the upstream pond gradually emptied

into the downstream river valley channel. The sudden surge of flow would result in a 16 ft. flood stage at the toe of the dam. Discharges and river stages would prevail as shown on the above table. Therefore, a flood crest owing to a structural failure occurring when the river was not in flood stage, would be more severe due to a sudden river stage rise, and the resulting downstream flood wave created thereby.

The most significant area to be impacted as a result of a breach of the dam would be an area extending downstream of the dam for a distance of more than one mile to Interstate Route 295. Seven or eight homes in the new housing development 700 ft. below the dam would be flooded to about a 9 ft. depth as the river could rise to a stage of more than 16 ft. in this area. In addition to the housing development on the right bank, just downstream there is an industrial complex which would be inundated. About 2,000 ft. downstream on the left bank is the community of Natick, where nearly fifty dwellings and commercial establishments would be flooded to about a 4-5 ft. depth; the river stage would be between 12 and 15 ft. in this vicinity. Below Natick village the river bank is flat and swampy, so as to absorb a sizable portion of the flood outflow volume. It is anticipated that the river would reach a much lower stage as it approached Interstate Route 295.

SECTION 6

STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observations. The field investigation revealed no significant displacements or distress that would warrant the preparation of stability computations based on assumed soil properties and engineering factors.

b. Design and Construction Data. No plans, specifications, or construction records of value to a stability assessment are known to exist.

c. Operating Records. There are no operating records of any significance to structural stability.

d. Post Construction Changes. The principal post construction change to the dam is the demolition of the gatehouse structure formerly containing 6 trench gates located at the northern end of the dam at the head of the mill race channel. This gate structure has been removed and the mill race filled in at its upstream end with earth fill for a distance of approximately 300 feet. A plan showing the type of fill used was reviewed and is presented in Appendix B.

The construction change outlined above corrected the deteriorating gate condition which existed prior to 1974.

e. Seismic Stability. The dam is located in seismic zone No. 1 and in accordance with recommended phase 1 guidelines, does not warrant seismic analysis.

SECTION 7

ASSESSMENT, RECOMMENDATIONS & REMEDIAL MEASURES

7.1 Dam Assessment

a. Condition. On the basis of the Phase I visual examination, Natick Pond Dam appears to be in generally fair condition. The deficiencies revealed, however, indicate that a further investigation should be carried out and that some remedial work is needed. The major concerns with regard to the overall integrity of the dam are as follows:

- (1) The inadequacy of the spillway and the overtopping potential of the millrace.
- (2) The presence of small trees in the pier on the left abutment.
- (3) The need for a further inspection of the ashlar face on the downstream side of the spillway and of the condition of the plunge pool below the toe of the dam at a time of low flood.
- (4) The lack of dewatering facilities.

In addition, of minor concern, is the presence of small trees and brush in the river channel downstream of the dam.

b. Adequacy of Information. The lack of in-depth engineering data does not permit a definitive review. Therefore, the adequacy of the dam cannot be assessed from a standpoint of reviewing design and construction data. This assessment is based primarily on the visual inspection, past performance, and sound engineering judgment.

c. Urgency. The recommendations and remedial measures enumerated below should be implemented by the owner within one year after receipt of this Phase I inspection report.

d. Need for Additional Investigations. Additional investigations are required as recommended in Para. 7.2.

7.2 Recommendations

It is recommended that the owner should retain the services of a competent registered professional engineer to make investigations and studies of the following, and if proved necessary, to design appropriate remedial works:

- (1) Make a thorough study of the hydrology of the drainage basin. Review the spillway adequacy and the overtopping potential of the old raceway fill and determine whether it should be raised.
- (2) Determine whether repairs are needed along the downstream face of the spillway or in the riverbed at the toe of the dam.

- (3) Inspect the overflow section of the dam during periods of low or no flow conditions.
- (4) Determine whether modifications to the crest of the overflow structure are required to aerate the underside of the overflow nappe.
- (5) Study the feasibility of incorporating dewatering facilities.

7.3 Remedial Measures

a. Operating and Maintenance Procedures

- (1) Remove small trees, brush and shrubs in the river channel to a distance of 500 ft. downstream of the spillway.
- (2) Remove saplings growing in the pier area on the left abutment.
- (3) Develop a formal flood warning plan to follow in the event of an emergency including round-the-clock monitoring during periods of heavy precipitation.
- (4) Institute procedures for an annual periodic technical inspection of the dam and its appurtenant structures.

7.4 Alternatives

The only practical alternative would be to breach the dam under the auspices of a registered professional engineer, with due consideration of environmental effects.

APPENDIX A
INSPECTION CHECKLIST

VISUAL INSPECTION CHECKLIST
PARTY ORGANIZATION

PROJECT Natick Pond Dam DATE 3 April 1979

TIME 1:30 p.m.

WEATHER Rain

W.S. ELEV. 49.5 U.S. N/A DN.S.

PARTY:

- | | |
|--------------------------------|-----------|
| 1. <u>Pasquale E. Corsetti</u> | 6. _____ |
| 2. <u>Roger F. Berry</u> | 7. _____ |
| 3. <u>Carl J. Hoffman</u> | 8. _____ |
| 4. <u>William S. Zoino</u> | 9. _____ |
| 5. <u>Rinaldo Ruggieri</u> | 10. _____ |

PROJECT FEATURE	INSPECTED BY	REMARKS
1. <u>Hydrology</u>	<u>Roger F. Berry</u>	
2. <u>Hydraulics/structures</u>	<u>Carl J. Hoffman</u>	
3. <u>Soils and Geology</u>	<u>William S. Zoino</u>	
4. <u>General Features</u>	<u>Pasquale E. Corsetti</u>	
5. _____		
6. _____		
7. _____		
8. _____		
9. _____		
10. _____		

PERIODIC INSPECTION CHECKLIST

PROJECT Natick Pond Dam DATE 3 April 1979
 PROJECT FEATURE Ashlar Masonry Dam NAME C. Hoffman
 DISCIPLINE Structures NAME _____

AREA EVALUATED	CONDITIONS
----------------	------------

OVERFLOW RUBBLE MASONRY DAM

Crest Elevation	48.6 MSL
Current Pool Elevation	1 foot above crest
Maximum Impoundment to Date	Not known
Surface Cracks	
Pavement Condition	
Movement or Settlement of Crest	None observed
Lateral Movement	None observed
Vertical Alignment	Appears good
Horizontal Alignment	Appears good
Condition at Abutment and at Concrete Structures	Appears good
Indications of Movement of Structural Items on Slopes	
Trespassing on Slopes	Not applicable
Sloughing or Erosion of Slopes or Abutments	None observed
Rock Slope Protection - Riprap Failures	Riprap apron below dam not visible. Its present existence not known.
Unusual Movement or Cracking at or near Toes	Inaccessible, could not be observed.
Unusual Embankment or Downstream Seepage	None observed
Piping or Boils	None observed
Foundation Drainage Features	None evident
Toe Drains	None evident
Instrumentation System	None evident

PERIODIC INSPECTION CHECKLIST

PROJECT Natick Pond Dam DATE 3 April 1979
 PROJECT FEATURE Spillway NAME C. Hoffman
 DISCIPLINE Structures NAME _____

AREA EVALUATED	CONDITIONS
----------------	------------

OUTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS

a. Approach Channel

General Condition	Good
Loose Rock Overhanging Channel	None observed
Trees Overhanging Channel	None observed
Floor of Approach Channel	Inaccessible

b. Weir and Training Walls

General Condition of Concrete	Granite Block - Good
Rust or Staining	Weir not accessible
Spalling	N/A
Any Visible Reinforcing	N/A
Any Seepage or Efflorescence	None observed
Drain Holes	None evident

c. Discharge Channel

General Condition	Fair
Loose Rock Overhanging Channel	None observed
Trees Overhanging Channel	Yes
Floor of Channel	Trees in Channel
Other Obstructions	None observed

APPENDIX B
ENGINEERING DATA



STATE OF RHODE ISLAND AND PROVIDENCE PLANTATIONS
DEPARTMENT OF ENVIRONMENTAL MANAGEMENT

PMT

DAM INSPECTION REPORT

DAM: #145 RIVER: Pawtuxet River WATERSHED: Pawtuxet/Lower DATE: 25 August 1978
DAM: Natick Pond Dam TOWN: West Warwick INSPECTED BY: Earle F. Prout, Jr. C.F.
OWNER: OTHER INTERESTED PARTY:
Mr. Rinaldo Ruggieri
27 Blossom Street
West Warwick, RI

REASON FOR INSPECTION: N.P.S.I.D. - High/ Small Hazard
Annual Inspection

* * * * *

REPORT:

- Current pool elevation: full, approx. 2" over spillway crest.

Dam Embankment: The only current dam embankment of this structure consists of the recent (1974) removal of the wooden gate structure to the left of the spillway and filling in of the raceway to the former mill complex downstream and the subsequent build-up of the embankment area. This embankment is grassed and with low weeds and in good condition. There are no signs of leakage or seepage.

Gates: The approach to the gate, which is to the left, and adjacent to, the spillway, is clear and unobstructed (photo 1). The rack & pinion gear mechanism is intact; however, its operability is doubtful, and a test of its operability at this time is neither critical nor advisable due to its age.

- Spillway: The granite block spillway shows no signs of irregularities across its crest, and any deficiencies at this time are doubtful. There are no indications of misalignment of blocks in the granite masonry abutment walls. The area immediately downstream of the toe of the spillway (approx. 12'-15') is clear of any obstructions. But then, the river becomes overgrown with small trees, brush, and shrubs.

Comments/Recommendations: The entire dam structure appears to be in structurally sound condition. The only remedial steps that might be suggested, if deemed necessary, would be the removal of trees in the downstream area.

DEPARTMENT OF NATURAL RESOURCES

DAM INSPECTION REPORT

DAM: #145 RIVER: Pawtuxet WATERSHED: Lower Pawtuxet
NAME: Natick Dam TOWN: W. Warwick
OWNER: Mr. Rinaldo Ruggieri
27 Blossom St.
West Warwick, R. I.
822-0514

REPORT ON: Inspection of in progress repair

REASON FOR INSPECTION: Request of owner

INSPECTION BY: Peter M. Janaros, Senior Civil Engineer.

DATE OF INSPECTION: 27 Aug. 1974

REPORT:

I inspected the area just upstream of the old gatehouse. It had been satisfactorily excavated and is ready for filling in (see photo below).

I told Ruggieri that I wanted to check the material he intends to use for the sand facing before it is placed.



DEPARTMENT OF NATURAL RESOURCES

DAM INSPECTION REPORT

DAM: #145

RIVER: Pawtuxet

WATERSHED: Lower Pawtuxet

NAME: Natick Dam

TOWN: West Warwick

OWNER: Mr. Rinaldo Ruggieri
27 Blossom St.
West Warwick, R. I.
822-0514

REPORT ON: Inspection of In Progress Repair

REASON FOR INSPECTION: Request of Owner to check progress of repair work.

INSPECTION BY: Peter M. Janaros
William B. Brinson

DATE OF INSPECTION: 8 May 74

REPORT:

Slight seepage observed at downstream toe of fill, as expected from design of fill (gravel drainage blanket in plan).

Ruggieri said he would notify this office after stripping out of silt, debris and wooden foundation of gate structure is complete and before placement of cutoff embankment is begun (see attached photo for current project status.)

Inspection is desirable at this critical point in the project to assure that a stable foundation is provided for the new cutoff embankment.

Mr. Gregg Smith of the West Warwick branch of the Providence Journal was present. He took some photographs and asked background and technical questions.



Sept. 6, 1973

Mr. Rinaldo Ruggieri
27 Blosson Street
West Warwick, R. I. 02893

Re: Approval of plans to repair the Natick Dam (R.I. Dam #145)

Dear Mr. Ruggieri:

This Department has reviewed your application, dated May 21, 1973, for approval of plans to repair the Natick Dam in West Warwick, R. I.

This Department hereby approves the proposed dam repair as detailed on the drawing and specifications submitted with the above-mentioned application and entitled, "Plan of Stabilized Dam Section;" dated August 28, 1973; designed by Peter V. Cipolla Co., Inc.; and stamped by Charles B. Clark, P.E.; PROVIDED THAT the repair does not deviate from that described in the above-mentioned drawing and specifications and that extreme caution is used during the repair to prevent downstream flooding. A copy of said plan is included for your files.

Said approval is subject to the provisions of all laws which are or may be applicable thereto. All work to be done under said application and approval must be completed on or before September 4, 1974, after which date this approval is null and void. Written notice must be filed with this office when the work to be done is begun and similar notice when said work is completed. Nothing in this approval shall be so construed as to impair the legal rights of any person. No responsibility for the stability or permanence of said dam is assumed by the State or any officer of the State, through or under this approval.

Very truly yours,

Dennis J. Murphy, Jr.
Director
Department of Natural Resources

DJM:PMJ:ds
Enclosure

WILLIAM H. BRYANT, PE, RLS
GUNTHER GREULICH, RLS
FRITZ PETERSOHN, RLS

LEONARD A. GAROFALO, RLS
ARMANDO GAMA, RLS
DANA W. MCKECHNIE, PE, RLS
ROBERT F. DAYLOR, PE, RLS
CHARLES E. CLARK, PE
JAMES H. WISWELL, RLS
EDWIN A. YOUNG, PE, RLS
JAMES P. LAPSLEY, RLS

CONSULTANT
PETER V. CIPOLLA, PE

PETER V. CIPOLLA CO., INC.

Consultants

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CRANSTON, R.I.
MANSFIELD, MASS.
DERRY, N.H.

August 30, 1973

Department of Natural Resources
83 Park Street
Providence, Rhode Island

Attention: Peter Jenaros, Senior Civil Engineer

Re: Our Project No. R-212, Ruggieri Spillway Study

Dear Mr. Jenaros:

Enclosed please find one print of our plan showing the proposed stabilization of the spillway across the Natick Pond section of the Pawtuxet River, on land belonging to Rinaldo Ruggieri.

We have attempted to keep this submission as graphically simple as possible, with the final solution the important thing.

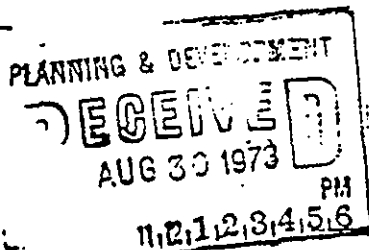
We hope this plan meets with your requirements.

Please do not hesitate to contact us if you have any questions.

Very truly yours,
Peter V. Cipolla Co., Inc.

Leonard A. Garofalo
Leonard A. Garofalo
Vice President

LAG/mat
enclosure



ENVIRONMENTAL ENGINEERING
GEODESY • TOPOGRAPHY • PHOTOGRAMMETRY • CARTOGRAPHY • HYDROGRAPHY
LAND SURVEYING • CIVIL ENGINEERING • LAND PLANNING



STATE OF RHODE ISLAND AND PROVIDENCE PLANTATIONS

Department of Natural Resources
DIVISION OF PLANNING AND DEVELOPMENT
83 Park Street
Providence, R. I. 02903

June 29, 1973

Robert B. Boyer & Associates
222 Quaker Lane
West Warwick, R. I. 02893

Dear Mr. Boyer:

In regard to your June 20, 1973 letter concerning the spillway at Natick Dam, it has always been the position of this office that the design to stabilize the spillway be left up to you and your engineer (see attached memo for record).

In other words, if you and your engineer feel that backfilling the trench is an acceptable method of spillway stabilization, then submit plans showing the type of materials to be used and the placement procedure, stamped by a Registered Professional Engineer, to that effect.

To date, this office has received three sets of plans from your office. These plans were received on March 16, 1973, March 27, 1973, and May 23, 1973 respectively. On each of these plans the focal point of design was a reinforced concrete cut-off wall placed on top of an existing wall. Yet, none of your plans identified the material the existing wall is made of or the condition of the wall.

Only my repeated insistence on knowing the suitability of the existing wall for its intended design function (i.e. supporting the proposed reinforced concrete cut-off wall), led to your June 20, 1973 inspection of the existing wall. In paragraph 5 of your letter, you, yourself, refer to structurally questionable wood members of the spillway.

My concern is and has been that these same wood members are supposed to support the proposed concrete cut-off wall in your plans. What you choose to call a bureaucratic process is in reality my refusal to approve plans in which such an obviously important design consideration has been omitted.

In regard to your question of Mr. Ruggieri's legal responsibility to maintain the dam and spillway, Section 46-19-4 of Rhode Island State laws clearly specifies that it is the owner's responsibility to maintain a dam in a safe configuration. Furthermore, land evidence books of West Warwick (Book 31, Page 144 and Book 67, Page 60) clearly specify that Mr. Ruggieri, as owner of Lots 1, 76, 77, Plat 41 does, in fact, own all dams, flumes, gatehouses and appurtenant structures associated with the abovementioned lots.

I trust that this letter answers the questions you have posed in your June 20, 1973 letter and hope that an appropriate design will be submitted without any further needless delay.

Very truly yours,

Peter M. Janaros
Senior Civil Engineer

PMJ:ds

Enc 1

cc: Mr. Rinaldo Ruggieri
West Warwick Town Council
Chief, Planning & Development

RECEIPT FOR

SERIAL NO.

STREET AND NO.

P.O., STATE AND ZIP CODE

OPTIONAL SERVICE

RETURN RECEIPT SERVICES

1. Show

2. Show

DELIVER TO ADDRESSEE

SPECIAL DELIVERY (2 Post)

NO

POD Form 3800

July 1969

NO

No. 525410

New Address

PMS

January 11, 1973

27 Blossom St.
West Warwick, R.I.

Mr. Rinaldo Ruggieri
17 Greene Ave.
Cranston, R.I. 02920

Re: Natick Dam
R. I. Dam #145

Dear Mr. Ruggieri:

On December 8, 1972 this office received a request from the West Warwick Town Council to investigate the "dam and water gate in Natick" (R. I. Dam #145). We were also informed by that Agency that you are the present owner.

The January 9, 1973 inspection by our engineering staff reveals that the entire water gate structure is extremely deteriorated and subject to failure during heavy rainfall periods. Downstream flooding would occur in the event of a failure of the gate structure. Thus the dam is considered unsafe and subject to the provisions of Sections 4619-4 and 4619-5 of the R. I. Laws. These provisions are enclosed for your information.

It is hereby requested that you telephone this office (277-2776) by January 19, 1973 to arrange an appointment so that we may discuss the present condition of, and necessary repairs or alterations, to the Natick Dam.

Very truly yours,

Dennis J. Murphy, Jr.
Director
Department of Natural Resources

PMS
EC:ds
cc: Edward P. Flanagan
Sldg. Inspector
West Warwick, R.I.
Encs: 2

(copy)

EDWARD P. FLANAGAN
BUILDING INSPECTOR
PHONE: 828-0080

STATE OF RHODE ISLAND AND PROVIDENCE PLANTATIONS

Town of West Warwick

BUILDING & ZONING DEPARTMENT

1170 MAIN STREET
WEST WARWICK, R. I. 02893

COAT OF ARMS



WEST WARWICK

June 25, 1971

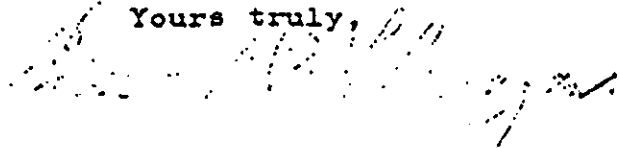
FROM : Edward P. Flanagan
Building Inspector
Town of West Warwick

TO: Rinaldo Ruggieri
16 Stanwood St.
Providence, R.I.

SUBJECT: GATE HOUSE ON PLAT 41--LOT #77

1. This structure was viewed by Mr. Ise of the Dept. of Harbors and Rivers, the West Warwick Fire Chief James Pryor and myself on Wednesday June 23, 1971, at this time it was decided that this structure should be removed or repaired.
2. This gate house is a fire hazard and a hazard to the area below, if the gate house should break, the area below would be flooded to the point of disaster.
3. Please contact this office immediately, so that a meeting with the previous mentioned men may be arranged to discuss this matter.

Yours truly,


Edward P. Flanagan
BUILDING INSPECTOR

cc: Chief Pryor
Mr. Ise
Town Council

EPF/ei

191

June 24, 1971

Mr. Edward P. Flanagan
Building Inspector
Town of West Warwick
1170 Main Street
West Warwick, Rhode Island

Dear Mr. Flanagan:

Natick Dam
R. I. Dam No. 145

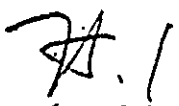
This is in further reference to my inspection of Natick Dam yesterday in company with Messrs. Duhaime and Pryor and yourself.

It was noted that the discharge gates assembly at the end of the dam is in extremely poor condition and potentially dangerous. It is subject to collapse under unusual water pressures created by heavy river discharge during floods. Action should be taken as soon as possible to eliminate existing hazards.

Any plans for rehabilitating the gates or removing them altogether should be cleared with this office for necessary state permission.

Please furnish us the name and address of the present owner of the dam so that the requirements of the law with respect to proper maintenance or breaching of dams may be brought to his attention.

Very truly yours,


H. Isé, Chief
Division of Harbors & Rivers

HI:mp

cc. Edward C. Hayes, Jr., Acting Director, Dept. of Natural Resources
Town Clerk, Town Hall, West Warwick, R. I.
General File

RECEIPT FOR CERTIFIED MAIL—20¢

No. 944150

SENT TO CLIFFORD D. Stone		POSTMARK OR DATE MAR 28 1968
STREET AND NO. BRIDGE ST - General Delivery		
CITY, STATE, AND ZIP CODE Warwick, R. I.		
If you want a return receipt, check which <input type="checkbox"/> 10¢ shows to whom and when delivered <input type="checkbox"/> 35¢ shows to whom, when, and address where delivered		If you want delivery only to addressee, check here <input type="checkbox"/> 50¢ fee
FEES ADDITIONAL TO 20¢ FEE		
PDD Form 3800 July 1963 NO INSURANCE COVERAGE PROVIDED—NOT FOR INTERNATIONAL MAIL (See other side)		

March 28, 1968

Mr. Clifford D. Stone
Bridge Street - General Delivery
Wyoming, Rhode Island

Dear Sir:

An inspection was recently made by a representative of this office of the condition of Natick Dam, R. I. Dam No. 145, in West Warwick, R. I.

The inspection revealed that the gate house is in quite a dilapidated condition, there are serious leaks in the gates, there is considerable debris on the upstream side of the gates and there is also debris on the crest of the dam.

The conditions enumerated above constitute a hazard that could conceivably cause serious damage to downstream property should there be any sudden break-through of water.

You are therefore requested to correct these hazardous conditions and to notify this office of your compliance with our request.

Very truly yours,



H. Isé, Chief

Division of Harbors & Rivers

HI:mp

Certified Mail -


Return Receipt Requested

cc. Charles E. Boyd, Director, Department of Natural Resources

Charles G. Bolwell, Chief, Division of Enforcement

W. J. Regnaire, Bldg. Inspector, Town of West Warwick, 1170 Main St.,
West Warwick, R. I.

General File

CFR 

C O P Y

Sent at old address - never rec. April 17, 1967
February 20, 1968

Mr. Clifford Stone
Bridge Street - General Delivery
Wyoming, Rhode Island

Dear Sir:

As the Building Inspector for the Town of West Warwick, on April 13, 1967 at 1:30 p. m., I investigated the hazardous condition existing off Greenhill Street on Assessors' Plat 41 Lots 77-76, property taxed to you, concerning the Water Gate and Gate House which are rotting away beyond repair.

If the water should rise, it would definitely break-through and flood the lower Section of Natick, possibly causing loss of life and personal property.

If you dispute my findings, I kindly suggest that you obtain an opinion from a qualified Construction Engineer.

You have twenty-one (21) days in which to correct this hazardous condition, or you shall be liable for damages caused by any sudden break-through of water through this dilapidated Water Gate and Gate House.

We are also reminding you at this time that excessive rubbish is still being dumped on this site causing a serious health and safety menace.

Yours truly,

Willie J. Regnaiere
BUILDING INSPECTOR

WJR:jk

cc



WILLIE J. REGNAIERE
BUILDING INSPECTOR
PHONE: 828-0080

STATE OF RHODE ISLAND AND PROVIDENCE PLANTATIONS

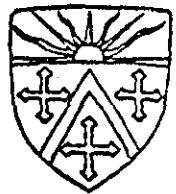
Town of West Warwick

BUILDING & ZONING DEPARTMENT

1170 MAIN STREET

WEST WARWICK, R. I. 02893

COAT OF ARMS



WEST WARWICK

March 12, 1968

CHIEF DIVISION OF HARBORS AND RIVERS
c/o Mr. Henry Ise
83 Park Street
Providence, Rhode Island

Dear Sir:

The Town of West Warwick Building and Zoning Department is hereby informing you of the hazardous situation existing off Greenhill Street, on Assessors' Plat 41 Lots 77-76, property taxed to a Mr. Clifford Stone of Bridge Street, Wyoming, Rhode Island 02898.

The Water Gate and Gate House found on this location is in a very dilapidated condition.

The Gate, found below the Natick Bridge, supports the canal formerly used for the Old Natick Mill and in its present condition, the water is seeping through the gate and could break through at any time thus flooding the lower section of Natick, risking life and personal property. In my estimation the water is running over the dam at approximately two to five inches at the present time.

Enclosed you will find copies of letters dated February 16, 1966 concerning the health and safety menace at the same address, at which time portions of the rubbish and garbage were cleaned up; one registered letter dated April 17, 1967, at which time was returned Unclaimed; and our final registered letter dated February 20, 1968, showing his new address, which he did receive.

We would appreciate your assistance in this matter as soon as possible for the safety of the surrounding neighborhood.

Yours truly,

Willie J. Regnaiere
Willie J. Regnaiere
BUILDING INSPECTOR

WJR:jk

Enclosures

C O P Y

February 16, 1966

Mr. Clifford D. Stone
254 Hill Street
Coventry, Rhode Island

Dear Mr. Stone:

You are hereby being notified on this 16th day of February A. D., 1966 by the Town of West Warwick Building and Zoning Department that the fire hazard and health and safety menace is still existing off Greenhill Street (the old Natick Mill site), Assessors' Plat 41, Lots 77-76-1 taxed to you in said Town.

Our letter dated November 18, 1965 requested you to clean up the above situation within 30 days. We received a call from you on November 19, 1965 at which time you promised to install "No Dumping" Signs on the property and clean up the existing rubbish and garbage.

As of this date, nothing has been done. This is our Final Notice, you have fourteen (14) days to install No Dumping Signs and clean up the alleged health and safety menace. If this situation is still existing after your fourteen days are up, we will be forced to turn this case over to the Town Solicitor for prosecution.

Yours truly,

Willie J. Regnaiere
BUILDING INSPECTOR



WJR:jsp

cc

DEPARTMENT OF NATURAL RESOURCES

DAM INSPECTION REPORT

DAM: #145

RIVER: Pawtuxet

WATERSHED: Lower Pawtuxet

NAME: Natick

TOWN: West Warwick

OWNER: Mr. Rinaldo Ruggieri

~~17 Greene Ave.~~

~~Cranston, R. I. 02920~~

27 Blossom St.
W. WARWICK.

822-0514

REPORT ON: Inspection of trench gates.

REASON FOR REPORT: Special Inspection by request of Town Council of W. Warwick.

INSPECTION BY: Peter M. Janaros

William B. Brinson

DATE OF INSPECTION: January 9, 1973

REPORT: Main spillway appears to be in good condition with no debris noted on crest. All six trench gates are inoperative and badly deteriorated as shown in photographs accompanying this report. Vertical support members are nearly rotted through. Should the entire trench gate structure fail, almost all the flow would be diverted from the spillway to the trench. The trench could not carry this total flow without flooding downstream areas because of control structures in the form of two small arches at the entrance of the mill building ruins. See sketch attached.

A letter will be written to the owner advising him of his obligations to maintain a safe structure under provisions of state law.

Peter M. Janaros
SENIOR CIVIL ENGINEER

March 28, 1968

MEMORANDUM

To: Mr. Henry Isé, Chief
From: Charles F. Replinger
Subject: Complaint - Condition of Dam No. 145
Natick Dam

On March 26, 1968 I inspected subject dam and found the gate house to be in a very dilapidated condition as evidenced by the attached pictures. There was considerable debris on the upstream side of the gate house and a good volume of water was leaking through the gates. In addition there was debris on the crest of the dam.


Charles F. Replinger



R.I. DEPARTMENT OF PUBLIC WORKS
DIVISION OF HARBORS AND RIVERS

SPECIAL INSPECTION REPORT

DAM NO. 145

INSPECTED BY J. V. KEILY

TOWN - WEST WARWICK & WARWICK

DAM NO. 145 NAME NATICK

ON RIVER PANTUXET RIVER
TRENCH

WATERSHED LOWER PANTUXET

OWNER NATICK LAND COMPANY (INC.)

ADDRESS RALPH L. LOOMIS, PRES. & TREAS., 185 DEVONSHIRE ST., BOSTON, MASS. LOCAL ATT'Y MAX WINGGRAB, 1807 TURKS

HEAD BLDG. PROVIDENCE, R.I. GA 8257
REPAIRS

INSPECTION ONLY X

WORK ON NEW CONSTRUCTION

MAINTAINED BY

APPROVED

CONTRACTOR

INSPECTION REPORT BY JOHN V. KEILY REASON ROUTINE

DATE 9/12/46

EMERGENCY:

1. MAX WINGGRAB, 1807 TURKS HEAD BLDG., PROVIDENCE, R.I. TEL. GA 8257
- 2.

9/12/46 CONDITION FAIR.

HEAVY MASONRY DAM; HIGH DROP; CROSSES ENTIRE RIVER WITH HIGH CUT GRANITE ABUTMENTS ON EACH SIDE. BUILT ON LEDGE; CONDITION GOOD; SPILLWAY CLEAR; ABUTMENTS NEED POINTING. EXTENSIVE MILLS AT SITE PRACTICALLY DEMOLISHED; TRENCH GATES CLOSED EXCEPT FOR SMALL PORTS IN SAME. GATES STILL OPERATED BY HAND, BUT BUILDING OVER SAME RAPIDLY DETEIORATING FROM NEGLECT AND LACK OF PAINT. DRY MASONRY IN TRENCH WALLS STILL IN GOOD CONDITION, APPARENTLY NO RESIDENT SUPERVISION OVER THIS LARGE DAM AT PRESENT TIME. OWNER LIVES IN MASSACHUSETTS.

OWNER

REASON

TYPE

CONDITION

LAW-OFF GATES

NUMBER

CONDITION

LENCES & WHEELS

REMARKS

DATE

CONDITION

APPROACHES

REASON

BRANCHES & TREES

RIPRAP

ESTIMATE

CONTROLS

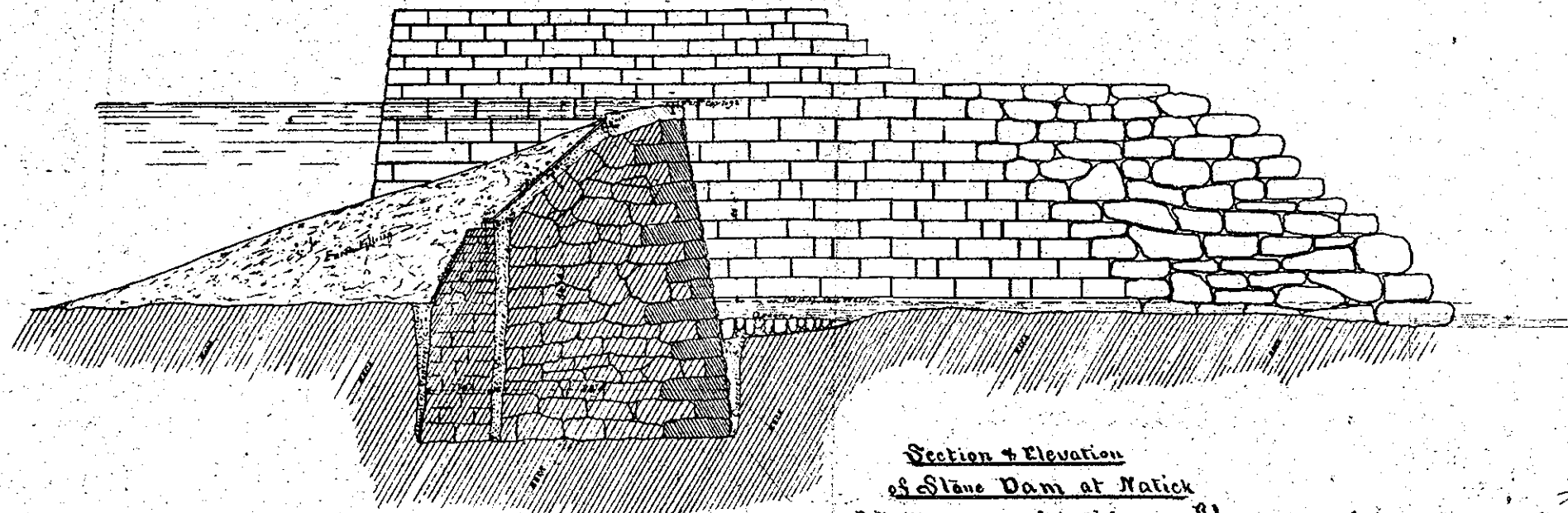
CONTACTED

A SITE

INSTRUCTIONS LEFT

IN EMERGENCY

CALL



Section on line A

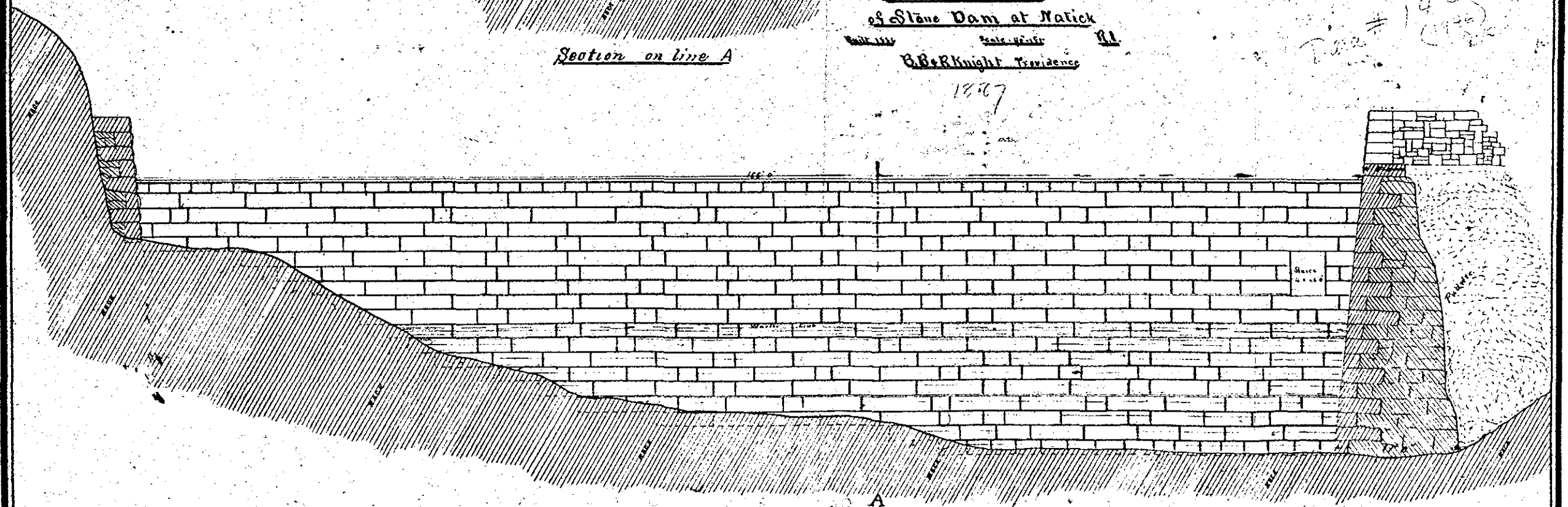
Section & Elevation
of Stone Dam at Natick

Scale 1/4" = 1' R1

B.B. Knight, Providence

1867

Dam #145
(1920)



Elevation

DAM #145

D2-27

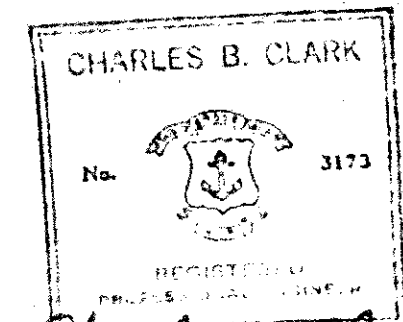
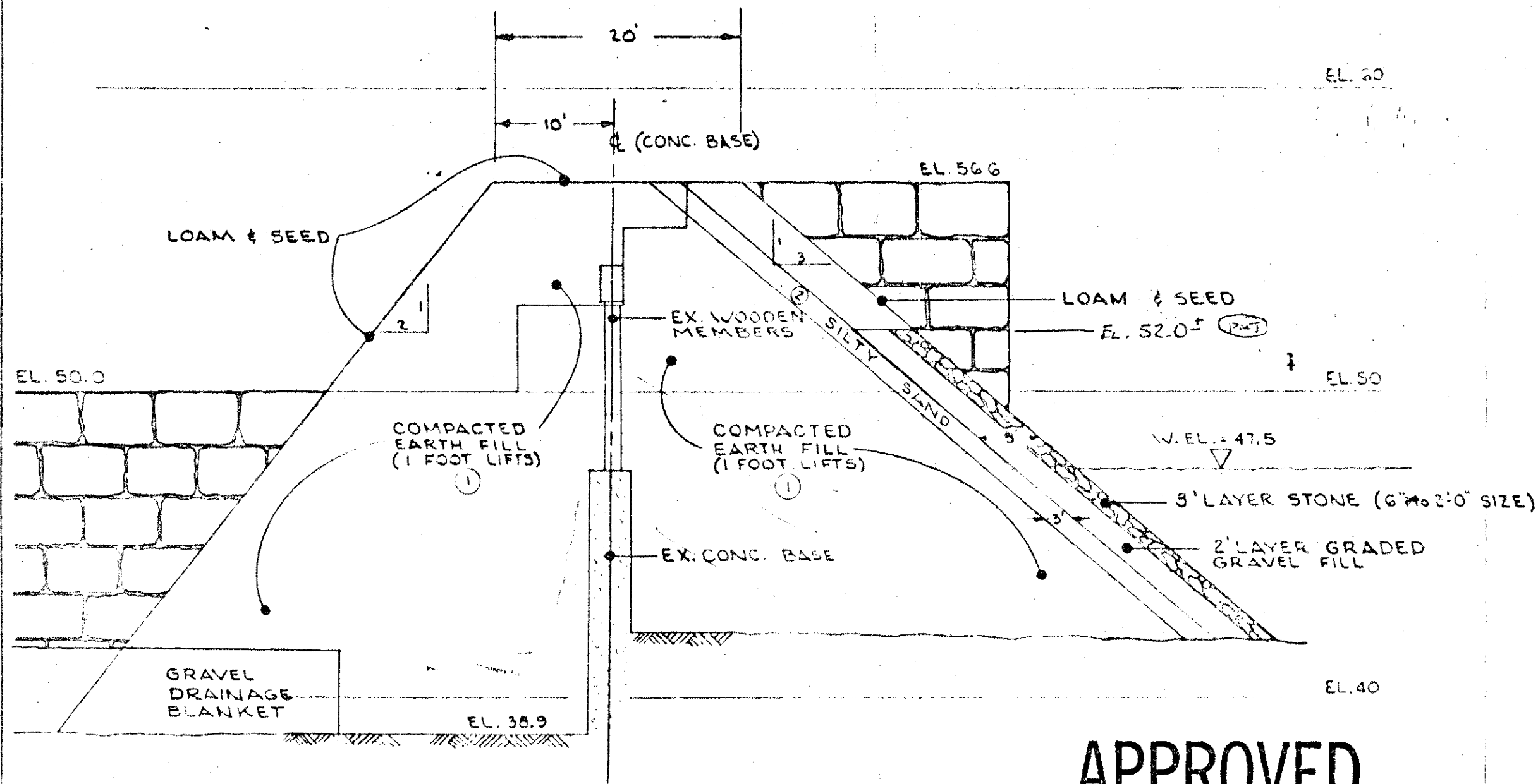
NOTES:

- (1) ALL MATERIAL TO BE REMOVED ABOVE EXISTING CONC. BASE
- (2) B.M. TOP OF HYDRANT IN FRONT OF 652 PROVIDENCE STREET
EL. 72.24 M.S.L.
- (3) W.E.L. SHOWN ON PAWTUCKET RIVER TAKEN 8/8/73

COEFF. OF PERMEABILITY (K)

- ① $K \approx 10^{-3}$
- ② $K \approx 10^{-4}$

- 1 Copy Office
- 1 Copy Wetlands
- 1 Copy Owner
- 1 Copy Engineer
- 1 Copy Town Council



PLAN OF
STABILIZED DAM SECTION
SITUATED IN
WEST WARWICK, R.I.

8-28-73

SCALES HOR. 1"=10'
VERT. 1"=4'

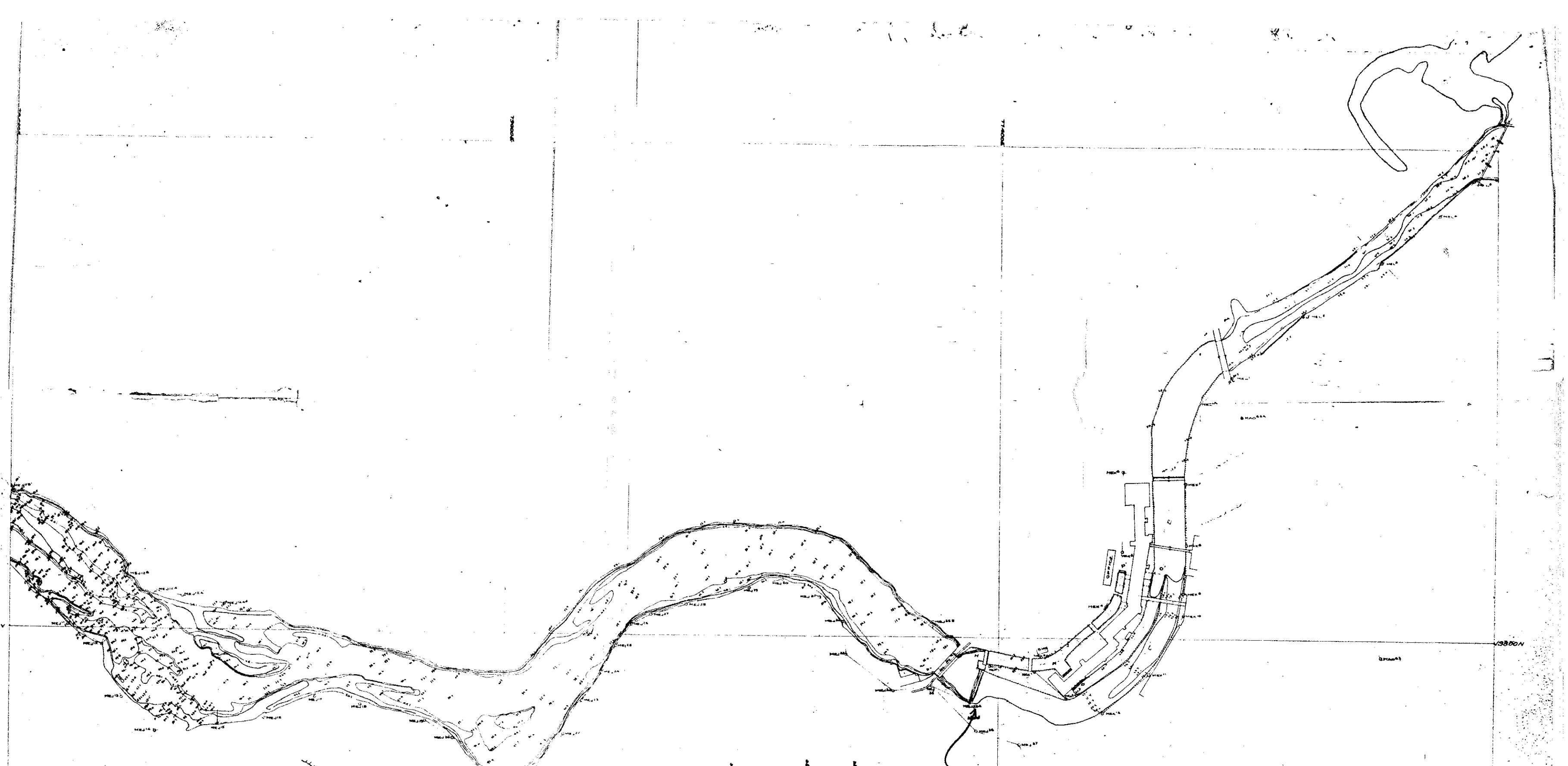
PETER V. CIPOLLA CO., INC.
- CONSULTANTS -
160 HILLSIDE ROAD
CRANSTON, R.I.

ASSOCIATED WITH BOSTON SURVEY CONSULTANTS

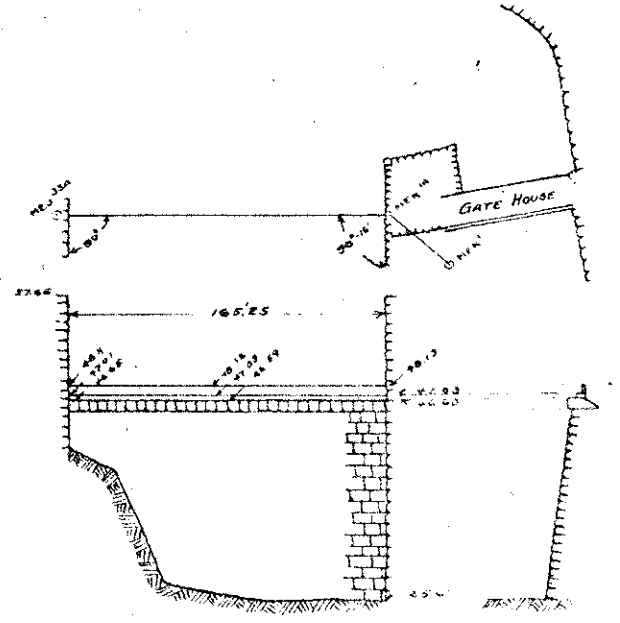
APPROVED
OFFICE COPY

SENIOR CIVIL ENGINEER

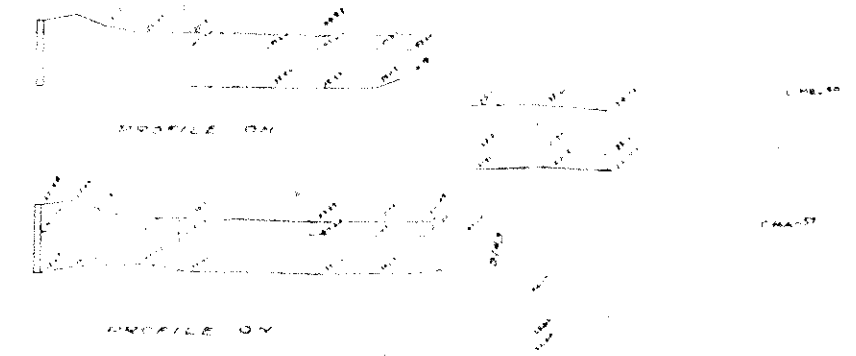
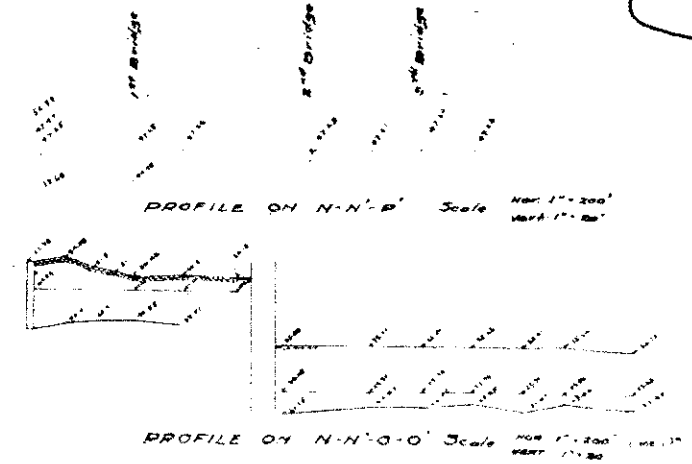
PREPARED FOR R. RUGGIERI



Natick Dam #145



SECTION A-A Scale 1"=10'



Natick Dam #145
Location Plan

1918 ±

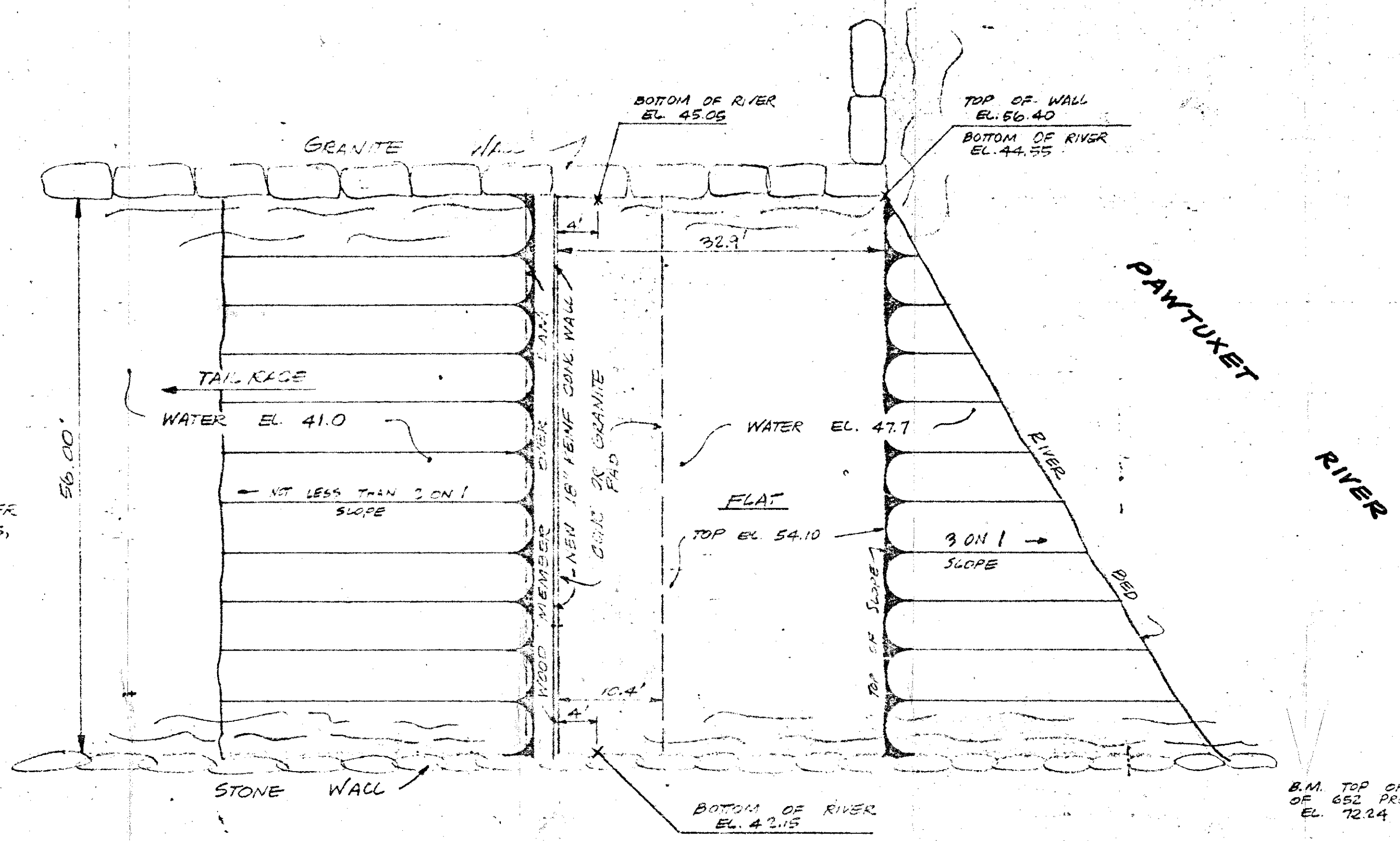
CITY OF PROVIDENCE
WATER SUPPLY BOARD

SCITUATE RESERVOIR
NATICK MILL POND AND POWER DEVELOPMENT



FILE Z 60PX. ACC. 2446

D2-49

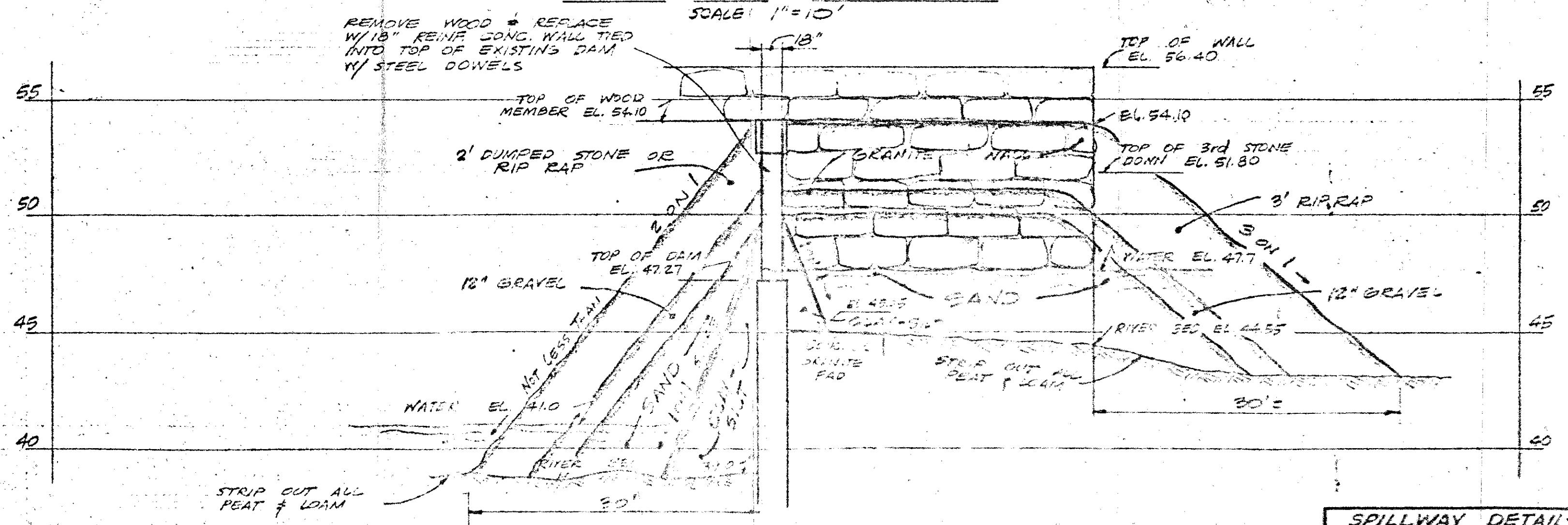


NOTE:
COMPACT IN 6" LAYERS WITH POWER EQUIPMENT & SHEEPSFOOT ROLLERS, IF POSSIBLE.

B.M. TOP OF HYDRANT IN FRONT OF 652 PROVIDENCE ST. EL. 72.24 M.S.L.

PLAN OF SPILLWAY

SCALE: 1"=10'



STRIP OUT ALL PEAT & LOAM

PROFILE OF TAILRADE

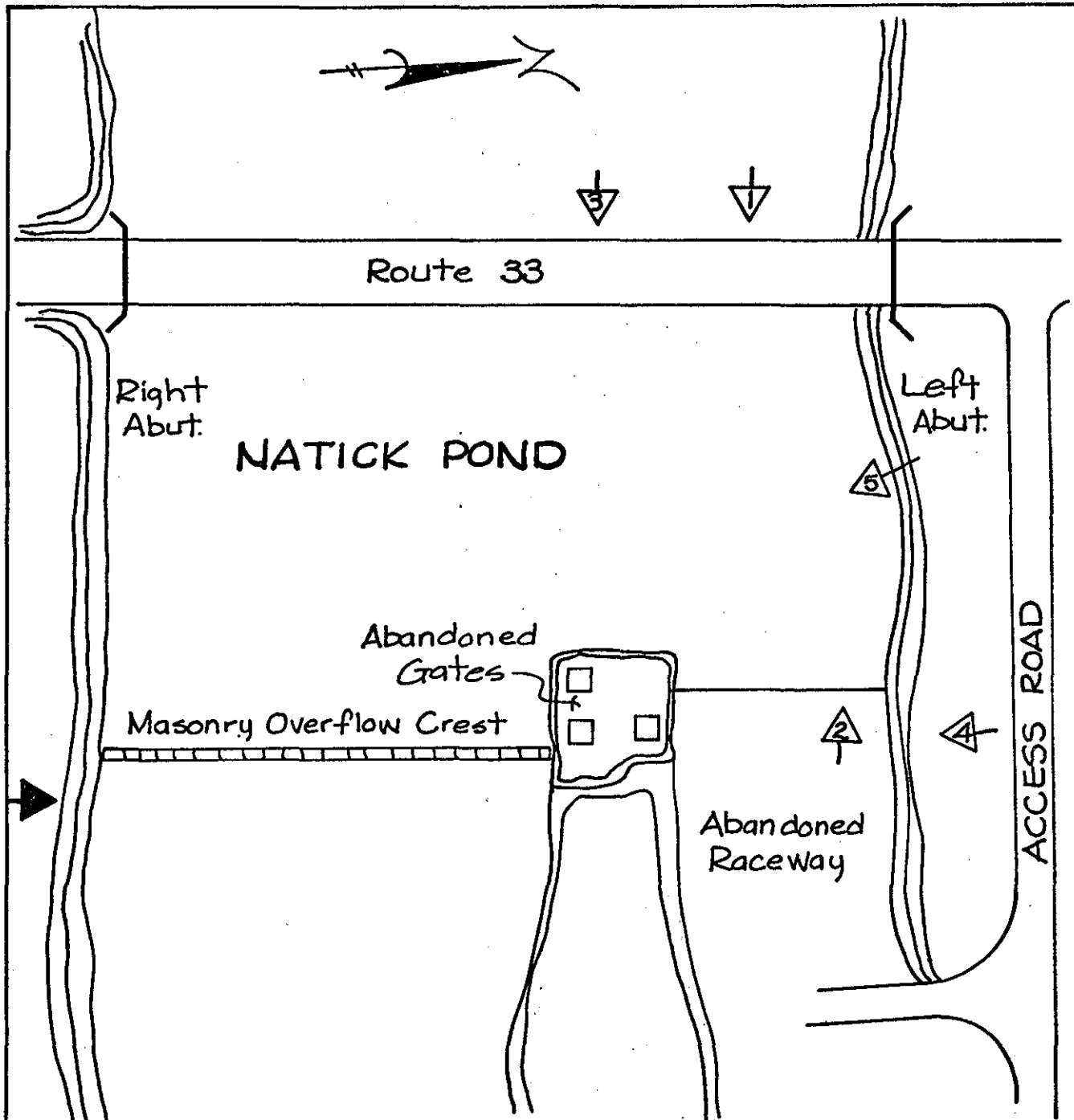
554.5 H.E. 1-270
1-4'

**PRELIMINARY
OFFICE COPY**

SPILLWAY DETAILS for RINALDO RUOGIERI OF NATICK DAM #135			
LOCATION	SCALE	DRAWN BY	REV.
WEST WARWICK, R.I.	AS SHOWN	REV. 50	
BY ROBERT B. BOYER & ASSOC.			
DATE	APPROVED BY	DRAWING NUMBER	
MAR, 1973		REV. 11.0 REV. 1.00	

APPENDIX C

PHOTOGRAPHS



LOUIS BERGER & ASSOC., INC
WELLESLEY, MASS.
ARCHITECT · ENGINEER

U.S. ARMY ENGINEER DIV. NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

NATICK POND DAM
SKETCH PLAN SHOWING LOCATION &
ORIENTATION OF PHOTOS

STATE - R.I.

			SCALE
			DATE

NATICK POND DAM



1. Downstream view of old mill raceway.



2. View of Rt. 33 immediately upstream of project.

NATICK POND DAM



3. Abandoned outlet gate controls.



4. View of outlet structure and spillway crest from left abutment.

NATICK POND DAM



5. View of right river bank immediately downstream
from project.

APPENDIX D

HYDROLOGIC AND HYDRAULIC COMPUTATIONS

BY REB DATE 4/20/79

LOUIS BERGER & ASSOCIATES INC.

SHEET NO. _____ OF _____

CHKD. BY _____ DATE _____

INSPECTION OF DAMS

PROJECT _____

SUBJECT NATICK POND - DEVELOPMENT OF PMF

D.A. = 182.4

SIZE CLASSIFICATION = SMALL

HAZARD CLASSIFICATION = HIGH

INSPECTION FLOOD = $\frac{1}{2}$ PMF TO FULL PMF

CALCULATE PMF USING "PRELIMINARY GUIDANCE
FOR ESTIMATING MAXIMUM PROBABLE DISCHARGE
IN PHASE I DAM SAFETY INVESTIGATIONS, MARCH
1978".

FROM: FLAT & COASTAL AREAS, No. 1

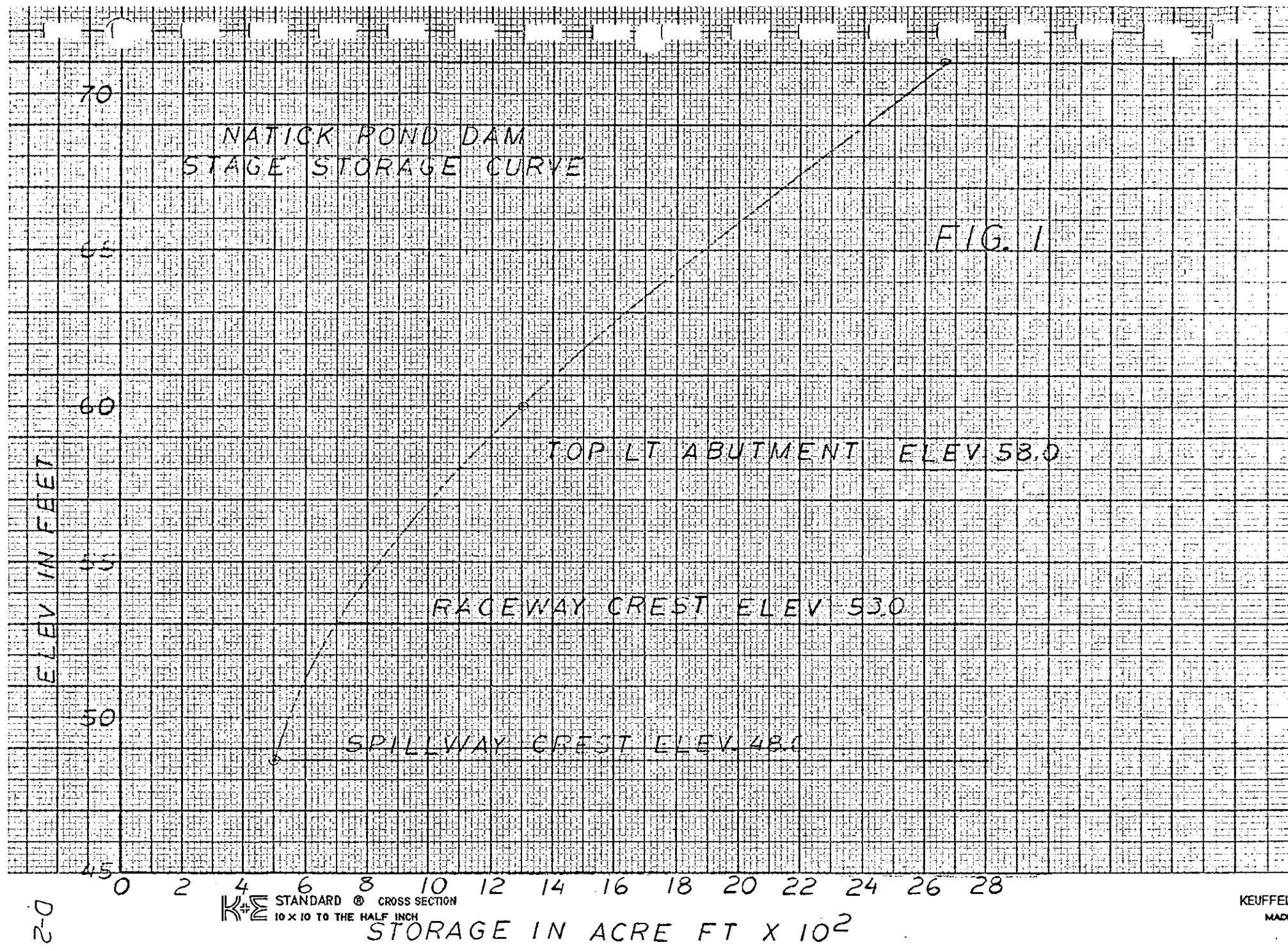
PAUTUXET RIVER :
SPF = 19,000 CFS
D.A. = 200 SQ MI
MPF = 190 CFS/SQ MI

FOR 200 SQ MI MPF = $200 \times 190 = 38,000$ CFS

FOR 182.4 PMF = $182.4 \times 190 = 34,656$

SAY FULL PMF = 34,700 CFS

$\frac{1}{2}$ PMF = 17,350 CFS



BY REB DATE 4/17/79

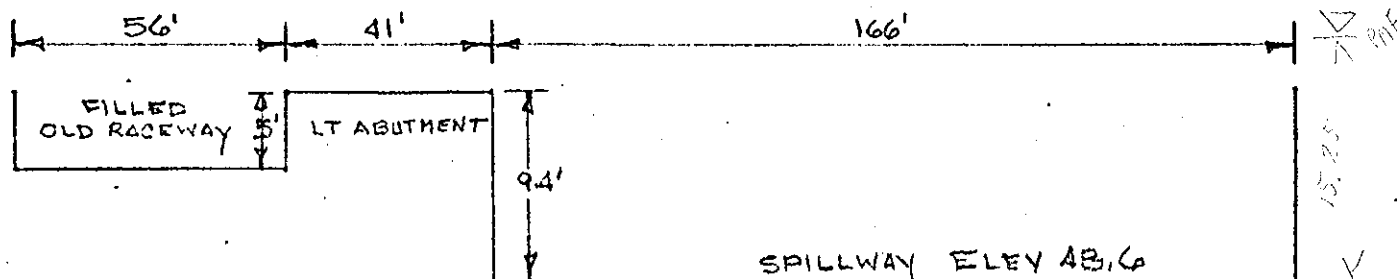
LOUIS BERGER & ASSOCIATES INC.

SHEET NO. _____ OF _____

CHKD. BY _____ DATE _____

INSPECTION OF DAMS - CONNERT

PROJECT _____

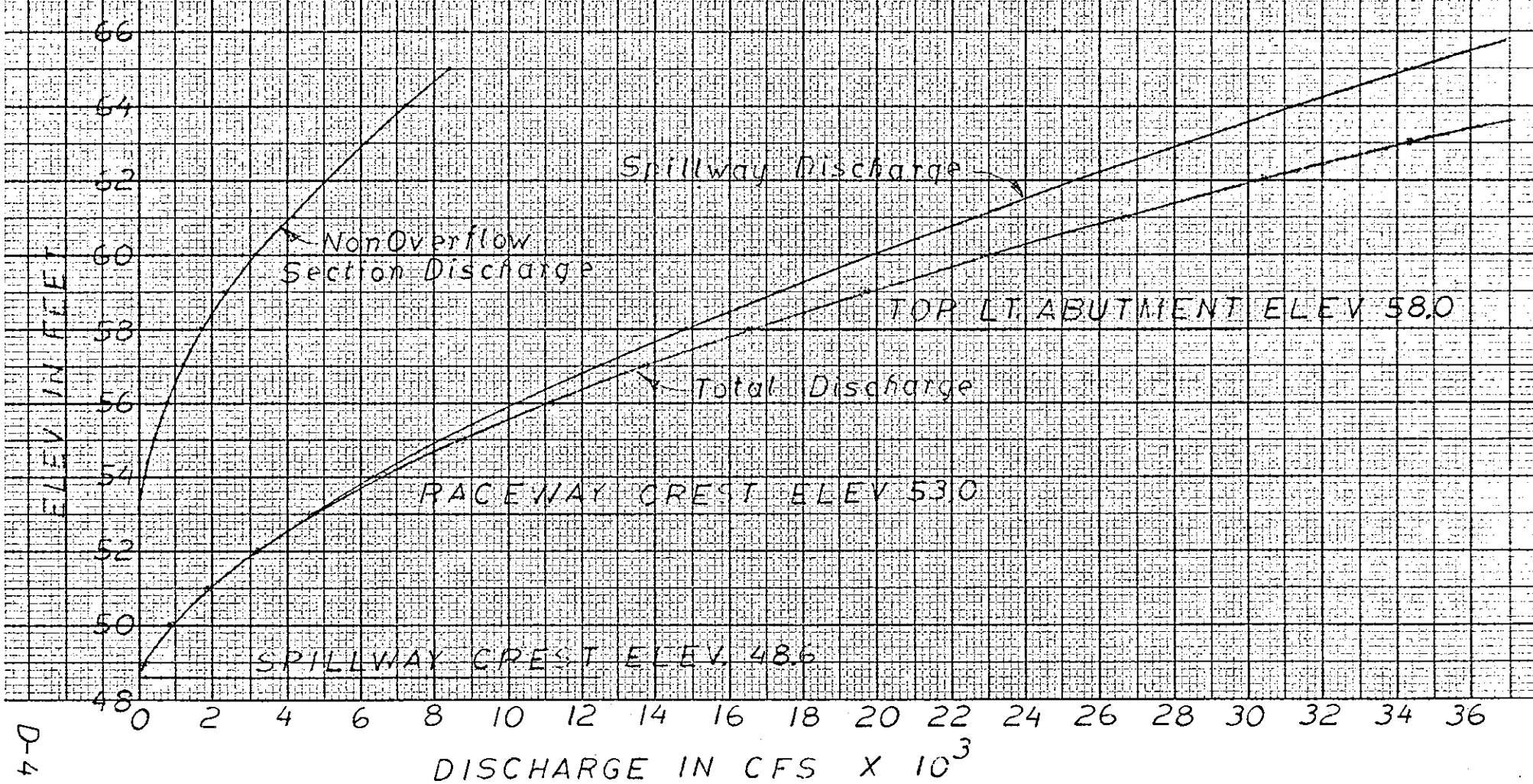
SUBJECT NATICK Pond DISCHARGE CURVES

DISCHARGE OVER SPILLWAY

ELEV.	LT ABUTMENT			SPILLWAY			RACEWAY			Σ Q's
	H	C	ΔQ ₁	H	C	ΔQ ₂	H	C	ΔQ ₃	
48.6	0	-	0	0	3.0	0	0	-	0	0
49.0	↑	↑	↑	0.4	3.01	126	↑	↑	↑	126
50.0	↑	↑	↑	1.4	3.02	830	↑	↑	↑	830
51.0	↑	↑	↑	2.4	3.03	1870	↑	↑	↑	1870
52.0	↑	↑	↑	3.4	3.04	3164	↓	↓	↓	3164
53.0	↑	↑	↑	4.4	3.05	4673	0	-	0	4673
54.0	↑	↑	↑	5.4	3.06	6374	1	2.7	151	6525
55.0	↑	↑	↑	6.4	3.07	8251	2	2.7	428	8679
56.0	↓	↓	↓	7.4	3.08	10292	3	2.7	786	11078
57.0	0	-	0	8.4	3.09	12488	4	2.7	1210	13698
58.0	0	2.8	0	9.4	3.10	14831	5	2.7	1690	16521
59.0	1	2.8	115	10.4	3.11	17315	6	2.7	2222	19652
60.0	2	2.8	325	11.4	3.12	19935	7	2.7	2800	23060
61.0	3	2.8	597	12.4	3.12	22615	8	2.7	3421	26633
62.0	4	2.8	918	13.4	3.12	25405	9	2.7	4082	30405
63.0	5	2.8	1284	14.4	3.12	28301	10	2.7	4781	34366
64.0	6	2.8	1687	15.4	3.12	31300	11	2.7	5516	38502
65.0	7	2.8	2126	16.4	3.12	34397	12	2.7	6285	42802
66	8			17.4			13			47277
67	11		4180	20.4		47700	16		9680	61585

NATICK POND DAM
DISCHARGE CURVE

FIG. 2



BY RFB DATE 5/3/77

LOUIS BERGER & ASSOCIATES INC.

SHEET NO. 1 OF 1CHKD. BY DATE INSPECTION OF DAMSPROJECT SUBJECT NATICK POND - DOWNSTREAM HAZARD ANALYSIS

ASSUMPTION No. 1: ASSUME RACEWAY BREACHES @
WATER SURFACE ELEV 54.0

SPILLWAY $Q = 6374$ CFS

STAGE @ STA 0+00 = 13 FT

TRIAL Q THRU BREACH

$$Q_{PI} = 8/27 W_b \sqrt{g} Y_o^{3/2}$$

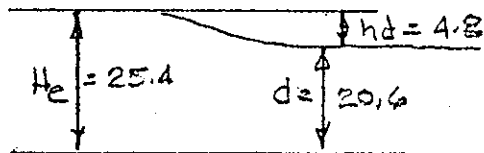
$$Q_{PI} = 8/27 (56) \sqrt{32.2} (25.4)^{3/2}$$

$$Q_{PI} = 1.48 (56) (25.4)^{3/2} = 12,043 \text{ CFS}$$

$$\text{SPILLWAY } Q = 6,374$$

$$\text{TOTAL } Q = 18,417 \text{ CFS}$$

CORRECT FOR TAILWATER EFFECT

FOR $Q = 18,417$ STAGE = 20'6" @ STA 0+00

$$\frac{hd+d}{H_e} = 1 \quad \text{COEFFICIENT} = 30\%$$

$$\text{BREACH } Q = .7 (12043) = 8430$$

$$\text{TOTAL } Q = 8430 + 6374 = 14,800 \text{ CFS}$$

REACH 1 SAY $L = 1000$ FT

$$V_1 = \frac{1000 \times A}{43520} = .023A$$

STEP 4

$$Q = 14,800$$

$$\text{STAGE} = 18.8$$

$$\text{AREA} = 6050$$

$$V_1 = .023A = 139$$

$$Q_{P2} (\text{TRIAL}) = 14,800 \left(1 - \frac{139}{760}\right) = 12092$$

$$Q = 12090$$

$$\text{STAGE} = 17.3$$

$$\text{AREA} = 5200$$

$$V_2 = .023A = 119.6$$

$$Q_{P2} = 14800 \left(1 - \frac{V_{avg}}{760}\right) = 14800 \left(1 - \frac{129}{760}\right)$$

$$Q_{P2} = 12284$$

$$\text{STAGE} = 17.4$$

D-5

BY REB DATE 5/8/79

LOUIS BERGER & ASSOCIATES INC.

SHEET NO. 2 OF CHKD. BY DATE INSPECTION OF DAMSPROJECT SUBJECT NATICK POND - DOWNSTREAM HAZARD ANALYSISREACH 2 L = 1000 FT $V_1 = .0234$

$$Q_{P1} = 12,280 \quad \text{STAGE} = 17.4$$

$$\text{AREA} = 5250 \quad V_1 = 121$$

$$Q_{P2}(\text{TRIAL}) = 12,280 \left(1 - \frac{121}{760}\right) = 10327$$

$$Q = 10237 \quad \text{STAGE} = 16.2$$

$$\text{AREA} = 4500 \quad V_1 = 104$$

$$Q_{P2} = 12280 \left(1 - \frac{V_{AVE}}{760}\right) = 12280 \left(1 - \frac{112.5}{760}\right)$$

$$Q_{P2} = 10460 \quad \text{STAGE} = 16.35$$

REACH 3 L = 1000 $V_1 = 0.0234$

$$Q_{P1} = 10460 \quad \text{STAGE} = 16.35$$

$$\text{AREA} = 4700 \quad V_1 = 108$$

$$Q_{P2}(\text{TRIAL}) = 10460 \left(1 - \frac{108}{760}\right) = 8975$$

$$Q = 8975 \quad \text{STAGE} = 15.35$$

$$\text{AREA} = 4100 \quad V_1 = 94$$

$$Q_{P2} = 10460 \left(1 - \frac{V_{AVE}}{760}\right) = 10460 \left(1 - \frac{101}{760}\right)$$

$$Q_{P2} = 9069 \quad \text{STAGE} = 15.4$$

REACH 4 L = 800 $V_1 = .0184A$

$$Q_{P1} = 9070 \quad \text{STAGE} = \frac{15.4 + 9.0}{2} = 12.2$$

$$\text{AREA} = \frac{4100 + 6500}{2} = 5300 \quad V_1 = 98.5$$

$$Q_{P2}(\text{TRIAL}) = 9070 \left(1 - \frac{98.5}{760}\right) = 7890$$

$$Q = 7890 \quad \text{STAGE} = \frac{14.5 + 8.6}{2} = 11.55$$

$$\text{AREA} = \frac{3650 + 5800}{2} = 4725 \quad V_1 = 86.9$$

$$Q_{P2} = 9070 \left(1 - \frac{V_{AVE}}{760}\right) = 9070 \left(1 - \frac{92.7}{760}\right)$$

$$Q_{P2} = 7963 \quad \text{STAGE} = \frac{14.55 + 8.65}{2} = 11.6$$

D-6

REACH 5 $L = 1000 \text{ FT}$ $V_1 = 0.023$

$Q_{P1} = 7963$ STAGE 8.65

AREA = 6000 $V_1 = 138$

$Q_{P2}(\text{TRIAL}) = 7963 \left(1 - \frac{138}{760}\right) = 6517$

$Q = 6517$ STAGE = 7.8

AREA = 5000 $V_1 = 115$

$Q_{P2} = 7963 \left(1 - \frac{V_{AVE}}{760}\right) = 7963 \left(1 - \frac{126.5}{760}\right)$

$Q_{P2} = 6641$ STAGE = 7.9

REACH 6 $L = 1000 \text{ FT}$ $V_1 = 0.0234$

$Q_{P1} = 6641$ STAGE 7.9

AREA = 5150 $V_1 = 118.5$

$Q_{P2}(\text{TRIAL}) = 6641 \left(1 - \frac{118.5}{760}\right) = 5605$

$Q = 5605$ STAGE = 7.4

AREA = 4600 $V_1 = 106$

$Q_{P2} = 6641 \left(1 - \frac{V_{AVE}}{760}\right) = 6641 \left(1 - \frac{112}{760}\right)$

$Q_{P2} = 5662$

5662 CFS < 6374 FLOW IS BACK TO NORMAL
FLOOD FLOW.

STAGE = 7.8

SUMMARY

STA	STAGE
0+00	18.8
10+00	17.4
20+00	16.4
30+00	15.4
38+00	11.6
48+00	7.9
	7.8

BY C. J. R. R. P. DATE 5/9/79

LOUIS BERGER & ASSOCIATES INC.

SHEET NO. 4 OF CHKD. BY DATE INSPECTION OF DAMPROJECT SUBJECT NATICK POND DAM - DOWNSTREAM HAZARD ANALYSIS

ASSUMPTION No 2 - ASSUME SPILLWAY BREACHES AT
WATER SURFACE ELEV 48.6

$$Q = 8/27 Wb \sqrt{g} y_0^{3/2}$$

$$Q = 1.68 (65) (20)^{3/2}$$

$$Q = 9770 \text{ CFS}$$

REACH 1 L = 1000 STORAGE S = 760 $V_1 = \frac{1000A}{43.525} = 0.023A$

Q _{P1}	STAGE d ₁	SECTION AREA A ₁	V ₁ .023A	Q _{P2} TRIAL Q _{P1} (1 - $\frac{V_1}{7.6}$)	STAGE d ₂	AREA A ₂	V ₂ .023A	$\frac{V_1 + V_2}{2}$	Q _{P2}	
9770	15.9	4400	101	8472	15.0	3880	89.3	95.1	8547	O.K.
REACH #2	L=1000	STA 20		8550	15.0	3880	89.2	95.1	8547	O.K.
8550	15.0	3880	89.2	7546	14.3	3500	80.5	84.9	7595	O.K.
REACH #3	L=1000	STA 30								
7595	14.3	3500	80.5	6790	13.5	3200	73.6	77.1	6825	O.K.
REACH 4	L=800	STA 38								
Q _{P1}	d ₁	A ₁	TRIAL d ₂	TRIAL A ₂	AVE A	AVE V ₁	AVE Q _{P2}	d ₂		
6825	13.5	3200	8.5	5700	4450	81.9	6090	7.6		
			7.8	5000	4100	75.4	6150	7.8	OK	
REACH 5	L=1000	V=.023A	STA	48+00						
6150	7.8	5000	7.3	4500	4750	109.3	5266	7.2		
			7.2	4300	4650	107.0	5285	7.2	O.K.	
REACH 6	L=1000	V=.023A	STA	58+00						
5285	7.2	4300	7.0	4150	4225	97.2	4609	6.8		
			6.8	4000	4150	95.2	46.21	6.8	O.K.	

STA 0+00 15.9
STA 10+00 15.0
STA 20+00 14.3
STA 30+00 13.5

STA 38+00 7.8
STA 48+00 7.2
STA 58+00 6.8

BY RFB DATE 4/19/79

LOUIS BERGER & ASSOCIATES INC.

SHEET NO. 5 OF 5

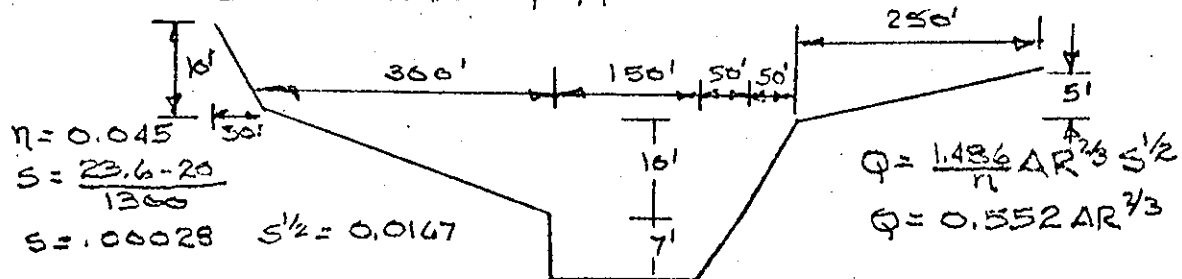
CHKD. BY _____ DATE _____

INSPECTION OF DAM

PROJECT _____

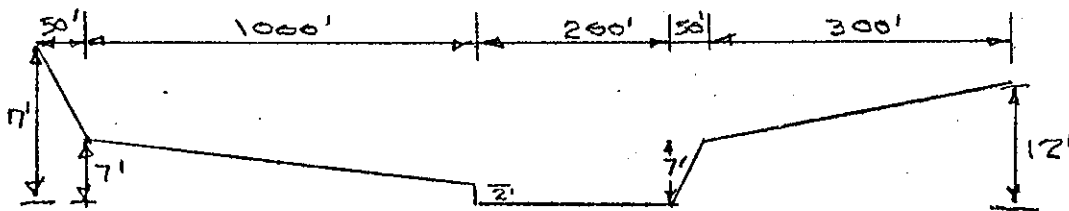
SUBJECT NATICK Pond DAM - DOWNSTREAM HAZARD ANALYSIS

STEP 3 REACHS 1, 2, & 3



d	Δ AREA	Σ AREA	W.P.	R	$R^{2/3}$	Q
0	0	0				
2	314	314	166.1	1.89	1.53	265
7	910	1224	207.5	5.90	3.27	2209
12	1438	2662	383.1	6.95	3.64	5349
17	2312	4974	558.7	8.90	4.30	11806
22	3437	8411	834.2	10.08	4.67	21682

REACHS



d	Δ AREA	Σ AREA	W.P.	R	$R^{2/3}$	Q
0	0	0				0
2	414	414	216.1	1.92	1.54	352
7	3660	4074	1252	3.25	2.19	4925
12	7062	11136	1576	7.06	3.68	22621

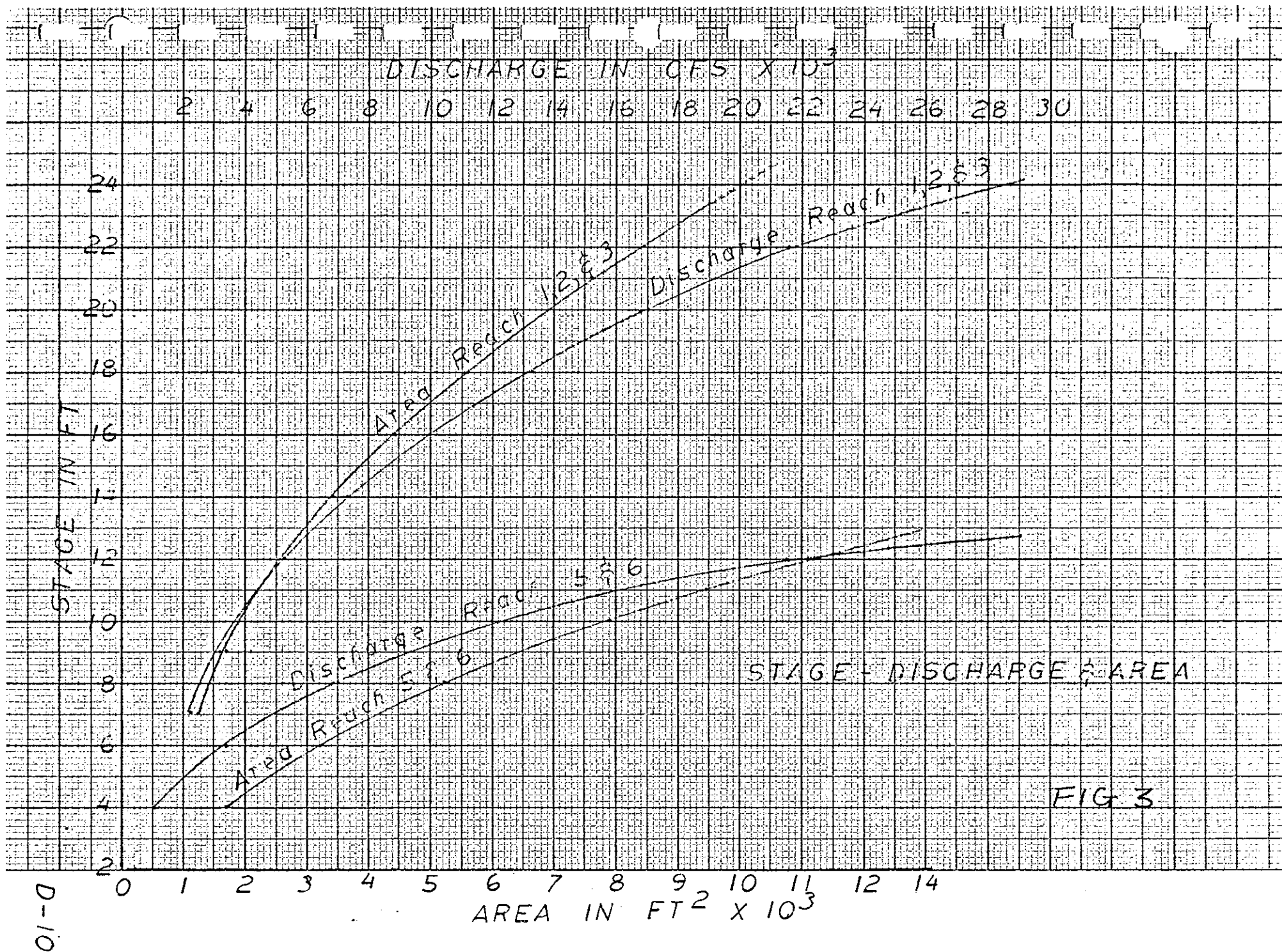




FIG. 4 , Sht. D - 11

APPENDIX E

INFORMATION AS CONTAINED IN
THE NATIONAL INVENTORY OF DAMS